# PROCEEDINGS

AND

# TRANSACTIONS

OF THE

# NATURAL HISTORY SOCIETY

# OF GLASGOW.

VOL. III. (NEW SERIES)—PART I.

1888-89.

(WITH 1 PLATE.)

GLASGOW: PUBLISHED BY THE SOCIETY

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# TRANSACTIONS

OF THE

# NATURAL HISTORY SOCIETY OF GLASGOW.


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I.

## *REVISION of the SCOTCH PERISPORIACEAE.*


BY PROFESSOR JAMES W. H. TRAIL, A.M., M.D., F.L.S.


[Read 27th December, 1888.]

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In Dr. Stevenson's very useful work, the *Mycologia Scotica,* the species of Perisporiaceae then known to occur in Scotland were enumerated, and their provincial distribution was detailed, as fully as was then possible. But during the nine years that have elapsed since the appearance of Dr. Stevenson's book our information with regard to this, as well as to other families of fungi, has been largely extended both within Scotland and by the publication of numerous important works relating to the fungi of Europe and of the United States of America. Fuller knowledge has rendered changes in the nomenclature of some species imperative in obedience to the law of priority; while certain forms that were enumerated in the *Mycologia* as good species are not founded on characters such as to justify their retention in this rank. Induced by these considerations, I have attempted a revision of the group, so as to indicate the actual state of our knowledge of the Scotch species at this date. The number of species here recorded from Scotland is not so much greater than the number mentioned in the *Mycologia* as might have been anticipated, but the differences in nomenclature are considerable, and the real increase is larger than at a first glance it appears to be.

As regards the distribution in Scotland of the several species, I adhere to the division into river-basins first suggested by Dr. Buchanan White (*Scot. Nat.*, Vol. 1, p. 161), and followed in the *Mycologia*, only separating the province of Moray by the Caledonian Canal into the two provinces of Moray and Cromarty. Of these two, Moray has had its fungi investigated by Dr. Keith with a success not equalled elsewhere in Scotland; but the fungi of Cromarty are still almost unrecorded.

In the subjoined list the numbers and names under which the species stand in the *Mycologia Scotica* are given in brackets, following the letters "M.S." Brief descriptions are given of species that are not included in Cooke's *Handbook of British Fungi*, for the convenience of botanists who may not have ready access to foreign works.

I have noted the name of the discoverer (*D.*) and of the recorder (*R.*) in the case of each species of which I know these particulars, of course only as regards their history as *Scotch* plants. In the hope of adding to the value of this revision I have added the usual sign (!) after the names of all those host-plants on which I have found the fungi in Scotland, and also after all those provinces in which I have myself seen the latter growing, whether such host-plants or such distribution had been previously recorded or not.

## Sub-family I. ERYSIPHEAE.

### Genus 1. Sphaerotheca Lev.

1. **S. pannosa** (Wallr.) Lev. (M.S. 1825).— On *Roses*! both wild and cultivated, forming a dense mycelium on the leaves and young twigs and buds, in summer and autumn.

Clyde! Tay! Argyle! Dee! Moray!

Almost throughout Europe, in India, and in North America.

2. **S. Castagnei** Lev. (M.S. 1826).—Forms a pale coat either in spots, or along the edges of the leaves, or

covering almost their whole surface, upon *Spiraea Ulmaria*! *Alchemilla vulgaris*! *Taraxacum officinale*! and *Humulus Lupulus*!, to which last plant it is often very destructive even in Scotland. Summer and autumn.

Forth! Clyde! Tay! Dee! Moray! Orkney!

Almost throughout Europe, in Siberia, and in North America.

3. S. **Epilobii** (Link) Sacc. (*Scot. Nat.*, 1886, p. 220) (*D. and R. Trail*).—Not scarce in summer and autumn, upon *Epilobium montanum* and on *E. parviflorum.*

Tay (near Montrose)! Dee!

Central Europe.

This species approaches very near *S. Castagnei*, from which it differs chiefly in minor points—forming a denser mycelium, bearing erect sterile hyphae, as well as fertile ones, and also having perithecia provided with radiating brown appendages.

## Genus 2. **Podosphaera** Kunze.

Of this genus we have three forms in Scotland, viz., *P. tridactyla* (Wallr.)=*P. Kunzei* Lev. (M.S. 1831), *P. myrtillina* (Schub.)=*P. Kunzei*, var. *myrtillina* Kunze (M.S. 1831 var.), and *P. Oxyacanthae* (DC.)=*P. clandestina* Lev. (M.S. 1832). These three forms are very similar to one another, so much so indeed that they are regarded by some mycologists as actually belonging to a single species. But without seeking to dispute the close relationship that exists between them, we may, in the meantime at least, regard them as distinct, since they show structural characters by which they may be recognised, besides the distinction in their food-plants. *P. tridactyla* and *P. myrtillina* both have a poorly-developed mycelium (which may readily be overlooked), but the perithecia are plentiful. The appendages of the latter in *P. tridactyla* on the top are few, erect, and stiff, and the sporidia are about $20\mu$ long; while in *P. myrtillina* the appendages are rather more numerous, and radiate outwards or bend downwards, and the sporidia are $25\mu$ to $30\mu$ long. *P. Oxyacanthae* renders its attacks very evident by covering all the young leaves and the tips of the twigs with a grey mycelium, on which the perithecia are produced only at rather a late season of the year, if at all; and the sporidia are slightly smaller than in *P. tridactyla.*

4. **P. tridactyla** (Wallr.) De Bary.—On leaves of *Prunus Padus*! in the latter part of summer and in

autumn. Though recorded in *Myc. Scot.* as living on *Sorbus*, I do not know of its occurrence on this plant.

Tay! Dee! Moray!

England, Europe, America.

5. **P. myrtillina** (Schubl.) Kunze (*D. Keith*).

Dee, Moray!

Europe.

On *Vaccinium Myrtillus*! on the lower surface of the leaves, in autumn. It was recorded by Dr. Keith from Moray; and I found it very plentiful within a few miles of Aberdeen in 1887. Plants infested by it grow so much taller than healthy plants that its presence becomes very noticeable. I have not observed it on any other *Vaccinium* in Scotland; but have gathered it in the Hardanger district, in Norway, on *V. uliginosum*.

6. **P. Oxyacanthae** (DC.) De Bary.—On *Crataegus Oxyacantha*! and on *Pyrus Aucuparia*! in summer and autumn.

Clyde! Tay! Dee! Moray! Orkney (host-plant introduced)!

England, Europe as far as Norway, North Africa.

Genus 3. **Phyllactinia** Lev.

7. **P. suffulta** (Reb.) Sacc. (*P. guttata* Lev., M.S. 1827).—On *Corylus Avellana*! *Betula alba*! and *Alnus glutinosa*! common in autumn.

Forth, Clyde! Tay! Dee! Moray! Orkney (on *B. alba*, introduced)!

England, throughout Europe, Siberia, N. America.

Genus 4. **Erysiphe** (Hedwig) DC.

Several of the species of this genus are of very doubtful value, as the distinguishing characters are frequently very slight. The subjoined record thus differs considerably from that in *Mycologia Scotica*.

8. **E. Linkii** Lev. (M.S. 1836).—On leaves of *Artemisia vulgaris*, in autumn.

Forth, Tay, Moray, Cromarty!

England, Central and Southern Europe, Siberia.

9. **E. Martii** Lev. (M.S. 1839).—Very common on the leaves of Leguminosae, *e.g.*, *Pisum sativum* (Pea)! *Lotus major*! *Trifolium dubium*! *T. minus*! *T. medium*!

*Vicia Cracca*! *V. sylvatica*! *Lathyrus pratensis*! and also on *Hypericum hirsutum*! in summer and autumn.

Forth, Clyde! Tay! Dee! Moray! Ross.

England, Europe, Siberia, N. America.

10. E. **Umbelliferarum** De Bary (*Scot. Nat.* 1886, p. 229) (*D. and R. Trail*).—On leaves of various Umbelliferae, *e.g.*, *Heracleum Sphondylium* (abundantly)! *Anthriscus sylvestris*! *Angelica sylvestris*! and *Pimpinella Saxifraga*! in summer and autumn.

Clyde! Tay! Dee! Moray!

Europe.

This *Erysiphe* is very like *E. Martii*, with which it is probably confounded in the *Myc. Scot.*, if we may judge from *H. Sphondylium* being named as a host of the latter; but it differs from that species in producing cylindrical (not elliptical) conidia, perithecial appendages brown at their base, and usually only from 2 to 4 (rarely 6) sporidia in each ascus, instead of from 4 to 8 in each, as in *E. Martii*.

11. E. **graminis** DC. (M.S. 1837).—On leaves of various grasses. It is especially partial with us to *Agropyrum repens*! *Arrhenatherum avenaceum*! *Poa pratensis*! *P. trivialis*! and *Festuca gigantea*!

Tweed, Forth, Clyde! Tay! Argyle! Dee! Moray! Ross, Orkney!

England, Europe, Asia, N. America, Australia.

The conidial condition (*Oidium monilioides*) is extremely common, and often seriously injures the infested plants; but the perithecia are far less frequently observed, as they are usually late in appearing, and as a rule contain sporidia only in spring.

12. E. **communis** (Wallr.) Fries (M.S. 1842).—On leaves of *Ranunculus repens*! and of *R. acris*! (and of Leguminosae, *fide* M.S.).

Tweed, Forth, Clyde! Tay! Argyle! Dee! Moray, Orkney!

England, Europe, Asia, N. America.

13. E. **Galeopsidis** DC. (*Scot. Nat.* 1886, p. 229) (*D. and R. Trail*).—On *Stachys sylvatica*! *S. palustris*! *Galeopsis Tetrahit*! *Lamium album*! *L. intermedium*!

and *L. purpureum* !, in late summer and autumn. The sporidia usually do not mature before spring.

Tay (Rannoch)! Dee! Moray (Gamrie)! Orkney!

Europe.

This differs from the next species chiefly in the sporidia not becoming developed till spring, and in the haustoria of the mycelium being lobed—differences such as to render it difficult to distinguish them except by the host-plants.

14. **E. Cichoracearum** DC. including *E. lamprocarpa* Lev. on *Plantago, E. Montagnei* Lev. on *Arctium*, and *E. horridula* Lev. on *Boraginaceae*.—This fungus has been found in Scotland upon *Arctium Lappa*! *Anchusa arvensis, Pulmonaria officinalis* (in garden)! *Symphytum officinale*! *S. tuberosum*! *Plantago major, P. lanceolata*! *P. maritima*! and *P. Coronopus*! in summer and autumn.

Forth, Clyde! Tay! Dee! Moray, Orkney!

Europe, Egypt, Siberia, N. America.

I have followed Winter in regarding *E. lamprocarpa* Lev. (M.S. 1837) on *Plantago* species, *E. Montagnei* Lev. on *Arctium* (M.S. 1840), and *E. horridula* Lev. (M.S. 1841) on *Boraginacae*, as all belonging to one and the same species. Personal examination of fresh specimens of the three has convinced me that they differ from one another in no respect that entitles them even to the rank of well-marked varieties.

15. **E. Astragali** DC. (*Scot. Nat.* 1886, p. 231) (*D. and R. Trail*).—Very plentiful on leaves and young shoots of *Astragalus glycyphyllus*! at St. Cyrus, near Montrose, in summer and autumn. The diseased plants become very conspicuous, owing to the abundant mycelium.

Tay!

Central and Southern Europe, N. America.

*E. Astragali* can scarcely be mistaken for any other species of this genus, both because of the peculiar host-plant, and because of the fact that of the very long slender perithecial appendages (usually about 12 to 16 in number) a few are bifurcated at the tip. This latter peculiarity has induced both Saccardo and Winter, following Leveille, to refer it to the genus *Microsphaera*; but, though it forms a transition towards the latter genus, it agrees better in the sum of its characters with *Erysiphe*. The perithecial appendages are mostly of the type

seen in *Erysiphe*; and the mode of branching of the bifurcated tips is very different from that of a true *Microsphaera*.

**Oidium Balsamii** Mont. (*D. and R. Trail*).

Under this name has been described a fungus that evidently belongs to the genus *Erysiphe*, or to some very closely allied genus; although from the absence of perithecia, which have not yet been detected, it is impossible to ascertain to what species it belongs. The conidia seem to approach on the whole very near to those of *E. Umbelliferarum* De Bary. It is of considerable practical interest, since it attacks various cultivated plants. Near Aberdeen I have seen it in great plenty upon turnips, preferring the Swedish to the common yellow turnip! It seems to appear chiefly towards the end of autumn. An excellent figure and description of it will be found in Mr. W. G. Smith's *Diseases of Field and Garden Crops*, pp. 75-79. What seems to be the same fungus has been observed in England on *Verbascum*, and on cultivated strawberry plants.

? **Erysiphe Rubi** Fuckel (*D. and R. Trail*).

This name has been given to what seems to be the mycelium of an *Erysiphe* (of which the perithecia are not yet known), which forms a thin white coat on spots on leaves of *Rubus Idaeus*. It has been recorded from Germany, France, and Portugal; and in the autumn of 1888 I found a few examples of it in the neighbourhood of Aberdeen.

### Genus 5. **Uncinula** Lev.

16. **U. Salicis** (DC.) Winter (*U. adunca* Lev., M.S. 1829).—On leaves of species of *Salix*, in autumn.
Forth, Moray.
England, Europe, Siberia, N. America.

17. **U. Prunastri** (DC.) Sacc. (*U. Wallrothii* Lev., M.S. 1828).—On leaves of *Prunus spinosa*, in autumn.
Tay, Moray.
England, Central and Southern Europe.

18. **U. Aceris** (D.C.) Sacc. (*U. bicornis* Lev., M.S. 1830).—On leaves of *Acer Pseudo-platanus*! and of *A. campestre*! in autumn.
Forth, Clyde! Tay! Dee! Moray!
England, Europe, Algeria.

### Genus 6. **Microsphaera** Lev.

19. **M. Berberidis** (D.C.), Lev. (M.S. 1834). — On leaves of *Berberis vulgaris*, in autumn.

Tweed, Forth, Clyde, Tay! Argyle, Dee! Moray.

England, Europe.

20. **M. Grossulariae** (Wallr.) Lev. (M.S). — On leaves of *Ribes Grossularia*, in autumn.

Tweed, Forth, Clyde, Tay! Argyle, Dee! Moray, Ross.

England, Europe, Siberia, N. America.

21. **M. Alni** (D.C.) Winter (*M. penicillata* Lev., M.S. 1833, and *M. Hedwigii* Lev., Scot. Nat. vol. VI., p. 165).—On leaves of *Viburnum Opulus*!, towards the end of summer and in autumn.

Tay! Argyle, Dee!

England, Southern and Central Europe, N. America.

I am not aware that this species has been found in Scotland on any other host-plant than *V. Opulus*, as I have been informed that "alder" noted for it in *Myc. Scot.* should have been "guelder-rose"; but I have gathered it on *Alnus incana* in Norway, and careful comparison of the Norwegian examples with *M. Hedwigii* from near Aberdeen and from Kenmore in Perthshire has led me to believe that there is no good specific distinction between the two. So, in like manner, I have been unable to distinguish between *M. Hedwigii* and *M. penicillata* by any constant difference; so that I agree with the view that the three must be regarded as forms of one species.

A considerable number of Scotch Phanerogams, in addition to those mentioned above as host-plants of Erysipheae, bear forms of *Oidium*, the mycelia of fungi belonging to this group; but I have not succeeded in detecting perithecia upon them, and am therefore unable to assign them with confidence to their several species. Among the favourite hosts are *Potentilla Tormentilla*! *Alchemilla arvensis*! *Senecio vulgaris*! *S Jacobaea*! and cultivated *Chrysanthemums*!

The following species of Erysipheae should be looked for in Scotland, as it is not improbable that some of them may yet be discovered here:

**Sphaerotheca Nieslii** Thum., on *Pyrus Aria*.

**S. detonsa** (Fr.) Kickx, on *Apargia*, in Belgium, and on *Tanacetum*, in the Vosges.

**S. fugax** Penz. and Sacc., on *Geranium silvaticum*, in Northern Italy.

**Podosphaera Schlechtendalii** Lev., on *Salix alba*

and *S. vitellina*, near Paris; easily known by the very long appendages.

**Uncinula Bivonae** Lev., on *Ulmus campestris*, in France and Germany.

**U. Tulasnei** Fuckel, on *Acer platanoides*, near the Rhine.

**Microsphaera Lycii** (Lasch.) Sacc. and Roum., on *Lycium europaeum*, in England, Central Europe, and North America.

**M. Dubyi** Lev., on *Lonicera* sps., in Belgium, France, Italy, and America.

**M. divaricata** (Wallr.) Lev., on *Rhamnus Frangula*, in Western Europe.

**M. Euonymi** (D.C.) Sacc., on *Euonymus europaeus*, in England, and in Western and Central Europe.

**Erysiphe tortilis** (Wallr.) Fr., on *Cornus sanguinea*, in England, and on the European continent.

**Oidium Tuckeri** Berk., on *Vitis vinifera*, too common in England and elsewhere.

Many American species of the family have been described, and of these some may occur in Scotland; but it would be making the circle too wide for my present object to mention these also.

## Sub-family II. PERISPORIEAE.

This group is readily distinguished from the former by the absence of the white mycelium. Instead of this the perithecia are not infrequently distributed on a blackish mycelium, resembling *Torula* or *Sporidesmium*. Some of the species are saprophytes, others are parasites.

### Genus 7. **Anixia** ? Fries.

22. **A perichaenoides** (Cooke) Sacc. (*Orbicula perichaenoides* Cke., M.S. 1823) *(D. Keith)*.—On an old fir beam at Forres.

Moray.

It is recorded as growing on dead cabbage stalks, rotten straw, &c., in Germany.

### Genus 8. Eurotium Link.

23. **E. herbariorum** (Wiggers) Link (M.S. 1845).—On damp plants in herbaria! only too common; also on decaying vegetable matter of all kinds.

Tweed, Solway, Forth, Clyde, Tay! Argyle, Dee! Moray, Ross, Orkney!

Nearly cosmopolitan.

24. **E. fulvescens** Cooke (M.S. 1846) *(D. and R. Cooke).*—On old sacking, in autumn, at Dupplin, near Perth.

Tay.

### Genus 9. Penicillium Link.

25. **Penicillium crustaceum** (L.) Fr. (M.S. 1465, conidial stage).—On moist decaying substances, very plentiful all the year through.

Tweed, Solway! Forth, Clyde, Tay! Dee! Moray, Orkney!

Cosmopolitan.

I am not aware that the asci of this fungus have been detected in Scotland.

### Genus 10. Apiosporium Kunze.

26. **Apiosporium Abietis** Cooke (Grevillea, vol. IX., p. 94; Scot. Nat. VI., p. 219, nec *A. Abietis* Kunze in Mycol. Hefte, I., p. 9) *(D. and R. Cooke).*—On twigs of living *Spruce Firs*, clothing them with a mass of sooty incrustation resembling a low form of *Sporidesmium.*

Forth (Glencorse).

This has been referred by Saccardo to his genus *Meliola*; but it differs too much from the type of that genus to admit of being placed in it. In the meantime it may be permitted to rest in the imperfectly-known genus *Apiosporium* Kunze; but if left here its specific name will require to be changed, being already preoccupied by Kunze's *A. Abietis.* I venture to suggest as suitable the name of *A. Cookei,* in honour of its discoverer.

### Genus 11. Lasiobotrys Kunze.

27. **Lasiobotrys Lonicerae** Kunze (M.S. 1824) *(D. Keith).*—Forms dark spots on leaves of *Lonicera Periclymenum*! in autumn.

Tay, Moray!
England, Europe, Siberia, Algeria.

Genus 12. **Perisporium** Fries.

28. **P. vulgare** Corda (M.S. 1822) *(D. Keith)*.—On old straw! and old matting!
Dee! Moray.
England, throughout Europe.

Genus 13. **Ascotricha** Berk.

29. **A. chartarum** Berk. (M.S. 1844) *(D. Buchanan White)*.—On decaying paper, at Perth.
Tay.
England.

Winter (Rabenhorst's *Krypt. Flora, Die Pilze*, vol. I., pp. 157-59) places this species in the genus *Chaetomium*. His description and figure differ so much, however, from the very brief description and figure in Berkeley's *Notices of Brit. Fungi*, No. 116, that it is doubtful whether they can belong to the same species. It seems preferable to retain it, therefore, in its former position, at least in the meantime.

Genus 14. **Capnodium** Mont.

30. **C. salicinum** (Alb. and Schw.) Mont. (*D. and R. Trail*).—On leaves of various species of *Salix*, and of other trees and bushes, forming a black sooty crust (*Fumago*), but rarely bearing perithecia.
Clyde! Argyle! Tay! Dee! Moray!
England, throughout Europe.

**C. quercinum** (Pers.) Berk. and Desm., which is very common in the Fumago-stage on Oaks in Scotland (*Scot. Nat.*, 1886, p. 229)! is probably a form of *C. salicinum.*

31. **C. Footii** Berk. and Desm. (M.S. 1847).—On leaves of evergreens in conservatories, and on laurel and ivy.
Tay, Moray.
Central and Southern Europe.

**Capnodium Citri** Berk. and Desm., which I have found plentifully upon young orange trees in a greenhouse near Aberdeen (*Scot. Nat.*, 1886, p. 229), may be a condition of *C. Footii;* but as fructification of

both is unknown it would not be advisable to hazard a decision.

32. **C. Juniperi** Phil. and Plowr. (*Grevillea*, vol. XIII., 1885, p. 75) (*D. Keith*).—On twigs of *Juniperus communis*, near Forres (Rev. Dr. Keith).

Moray.

"Perithecia globoso-cylindrical, contracted at the base, about 200$\mu$ high by 100$\mu$ wide, seated upon a thick dense felt of black mycelium, of which numerous black septate hyphae are attached to the base of the perithecia; asci ovate, 50$\mu$ by 20$\mu$; sporidia oval, with pointed extremities, brown, 3-septate, 2-seriate, 25$\mu$ by 10$\mu$. The mycelium envelopes the twigs in a thick woolly black mass. The antennarioid threads of which this mass is composed are possibly *Antennaria pithyophila* Nees."

### Genus 15. **Asterina** Lev.

33. **A. Veronicae** (Lib.) Cooke (M.S. 1848).—Forms a sooty coat on leaves and stems of *Veronica officinalis;* often quite abundant, though rather local.

Clyde! Tay! Argyle, Dee! Moray! Orkney!

England, Europe.

## APPENDIX.

I shall add here certain species which, though not strictly belonging to *Perisporiaceae*, inasmuch as the perithecia in them are provided with an opening for the escape of the sporidia, yet are so nearly related in other respects that they were included in the family in the *Mycologia Scotica*, following the arrangement in Cooke's *Handbook*.

### Genus **Microthyrium** Desm.

**M. microscopicum** Desm. (M.S. 1849).—On dying or dead leaves of *Buxus sempervirens*! and of other shrubs and trees. A form occurs near Aberdeen on dead leaves of *Quercus Robur* (oak)! which has received the name of *M. Quercus* Fuckel; but which does not differ in any essential respect from *M. microscopicum*.

Tay, Dee!

England, Europe, America, New Zealand.

Genus **Chaetomium** Kunze.

**C. elatum** Kunze (M.S. 1932).—On decaying stems of herbaceous plants! most common in spring.

Tweed, Forth, Clyde, Tay, Dee! Moray.

Throughout Europe and North America.

**C. indicum** Corda.—In the spring of 1888 Prof. D'Arcy Thompson sent me from Dundee a piece of jute sacking bearing this fungus. As the sacking had just been imported from Calcutta the species has no claim to rank as Scotch. It has been found in London, and on the European Continent, but always on imports from Asia.

II.

# *JOTTINGS FROM MY NOTE-BOOK.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

## Loch Fyne Herring.

[Read 27th November, 1888.]

There must be some cause by which to account for the high quality of the herring of Loch Fyne, and not merely a local reputation such as induces everyone to "think his own crow whitest." There are many reasons for believing that all our lochs, fresh and salt, on the West of Scotland, as well as every other sheet of water, have some particular animals in greater abundance than we find in any other place. Some lochs are rich in different species, others have species peculiar to themselves. Dr. John Murray of the *Challenger*, who has had daily acquaintance with the fauna of our lochs in the West of Scotland, summer and winter, for the last four years, informs me that *Conchœcia elegans* is abundant in Loch Etive, but has not occurred elsewhere, with the exception of one or two found on the surface in the Firth of Lorne. *Euchæta norvegica* is more abundant in Upper Loch Fyne than in any other loch in the West of Scotland; but it has never been found in Loch Aber, Loch Sunart, or Loch Carron. *Pasiphœa sivado* has never been found in Loch Fyne, but is most abundant in Loch Aber and Loch Etive. *Nyctiphanes norvegica* and *Boreophausia Raschii* have never been found in Loch Etive or in Loch Aber, but they were so plentiful in Upper Loch Fyne that the Duke of Argyll had over 24 lbs. of *Nyctiphanes* cooked and served to breakfast. *Nephrops norvegica* has never been found in Upper Loch Fyne, but is plentiful in other places in the Firth of Clyde.

These variations of haunt closely correspond with the habits of both large and small denizens of the sea which are drawn either temporarily or permanently to places where they find food and other conditions suitable to their wants, whether such be sought on a sandy, muddy, or gravelly bottom, or at a greater or less depth of water.

From the above facts we may assume that these lochs and other parts of the sea have peculiarities better fitted for some species than for others, where they may settle down, thrive, and multiply.

In a paper on investigations on the movements and food of herring, Mr. Fred. G. Pearcey, of the *Challenger*, states that "the food found in the stomachs of over a thousand herrings taken from various parts round the Shetland Islands consisted almost entirely of young fishes, chiefly *Ammadytes*, *Motella*, and *Pollochius*."* Mr. Thomas Scott, in a paper giving the results of the examination of a number of herring's and haddock's stomachs from various localities, remarks that "it is shown by this table [see paper], as by those given in former papers, that Schizopods and pelagic Amphipods form the chief food of the herring on the west coast. No Copepods were observed in the above cases in any of the stomachs sent from the East Coast districts."† It appears so far to be satisfactorily determined that as regards the Loch Fyne district copepods do form the greater part of the food of the herring during the summer. In the statistics given in the *Fourth Annual Report of the Fishery Board for Scotland* (1886), Appendix F, p. 128, it is shown that in the stomachs of herring caught in the Loch Fyne district copepods were observed more frequently than schizopods during the summer months, while in those examined in September both those groups were represented in nearly equal numbers.

Mr. Turbyne, an intelligent and careful observer

* *Proceedings of the Royal Physical Society of Edinburgh*, vol. viii., p. 395.

† *Sixth Annual Report of the Fishery Board for Scotland* (1888), Part III., Scientific Investigations, p. 228.

who has had the chief management of the dredging operations since the steam yacht *Medusa* came to the west coast about four years ago, informs me that last autumn when dredging in Upper Loch Fyne large hauls of copepods were obtained 5 and 10 fathoms from the bottom in depths of 70 and 75 fathoms. In one of these hauls a half-gallon bottle, now in the "Ark" (a branch at Millport of the Scottish Marine Station), was filled with them. They are mostly *Euchæta norvegica* and *Calanus finmarchicus*. Schizopods were also abundant in the same haul. These statements quite agree with my own notes made during many dredging expeditions in Loch Fyne, which I had the privilege of having in the yacht *Medusa*.

All the numerous samples of the work of the townet, both from Upper and Lower Loch Fyne, show the same result, viz., abundance of copepods and schizopods, summer and winter, affording plenty of food for the herring at all seasons of the year. Anyone who has paid attention to the copepods must have noticed that a large quantity of globules of oil come to the surface after the animals have been kept for some time in spirits. From this, as well as the soft and easily digestible consistence of their teguments, we may infer that they afford very rich food to those fish that feed upon them, when compared with the hard chitonous scales of the schizopods. Keeping in view that the herring of Loch Fyne feed greedily upon copepods, while these crustaceans do not seem to enter into the dietary of the herring on the east coast of Scotland, may not the rich quality and great abundance of this food account in a great measure for the superior quality of the "caller" Loch Fyne herring?

III.

# *REMARKS ON TEMPERATURE, VEGETATION, &c., IN THE ROYAL BOTANIC GARDEN, GLASGOW,* 1888.

BY ROBERT BULLEN, CURATOR.

[Read 29th January, 1889.]

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THE winter of 1887-88 was a rather prolonged one, and we had the unusual experience of a deficient rainfall followed by a wet and cold summer. The autumn, however, made considerable amends. Stormy weather has been experienced during the last two months, but otherwise the winter to this date (7th January) has been remarkably open and mild. Owing to the comparatively dry state of the soil last winter, fewer deaths than usual were recorded in the hardy herbaceous and alpine department.

During January frost was registered on twelve nights; the lowest reading was eleven degrees during the night of the 28th. The total record for the month was only 48° with the thermometer at 5 feet from the ground. On the surface of the ground the temperature was generally 2° to 3° lower during frost. Several fine days are recorded during the earlier part of the month, but afterwards real winter weather prevailed. Rain or snow fell on fourteen days, but was comparatively light for the month.

During February frost was registered on twenty nights. Five degrees were recorded during the night of the 1st, after which the mean temperature, both day and night, was unusually high until the night of the 9th, when it again fell to the freezing point. This sudden rise of temperature was no doubt owing to the earthquake which was felt here about 5 o'clock on the morning of the 3rd. From the 10th to the end of the month frost was more or less severe, the lowest reading being on the night of the 15th, when 16° of frost were registered. Total frost, 88°. The rainfall was exceedingly light this month. Vegetation was in an advanced state during the early part of the month. Catkins of the Common Hazel were hanging in great abundance, and various Lilacs, Ribes, Roses, etc., were nearly bursting their buds when the severe frost set in.

During March frost was registered on twenty-four nights; the lowest reading was 19°, or 13° of frost, during the night of the 16th. Ten degs. were also registered during the nights of the 4th, 17th, and 25th respectively. The remaining readings varied from one to eight degrees. Total, 128°. Although a low reading, it is not unusually so. What made the month so exceptionally winter-like were the heavy snowstorms, frequent and of long duration. Various Polemoniums, Tussilago, etc., were blooming away at their usual season underneath the snow; but vegetation generally was little in advance of what it was in the early part of last month.

During April the weather was very changeable, with an unlimited supply of cold east and north-east winds, but only a moderate rainfall. Frost was registered on eleven nights; the lowest reading was seven degrees during the night of the 8th. Total, 37°. Owing to the cold winds, vegetation made little progress, and all kinds of outdoor work were retarded.

During May frost was registered on four nights, but the thermometer never fell below the freezing point. From the 1st to the 18th the temperature

was a little below the average; from the latter date to and including the 26th the temperature was high, 69° being the maximum and 63° the minimum for the nine days. The rainfall was light until the evening of the 18th, when a severe thunderstorm was experienced, which was repeated with still greater severity on the afternoon of the 19th. A storm of such severity has been of very rare occurrence in this country. Hailstones covered the ground here, and were almost as large as marbles used by children at play. Professor Grant of the Glasgow Observatory reported at the time that the rainfall within one hour amounted to three-quarters of an inch, and exceeded any rainfall in the same space of time recorded in the annals of his observatory, with the exception of the memorable rainfall of 31st August, 1887. Vegetation developed most rapidly during the month, making considerable amends for a backward spring. Hardy trees and shrubs of all kinds were very prolific of bloom.

During June the mean temperature, especially in the shade, was very low, while the temperature in the sun was correspondingly high, particularly after the dry weather set in on the 13th; but owing to the continuous east and north-east winds the powerful sun-heat was little felt. Both hardy and half-hardy plants were stunted in growth; even the foliage of the common deciduous trees was smaller than usual, but their fruit was more abundant.

July was one of the most sunless, wet, and cold ever recorded here for that month. On the few days recorded as fine, north and north-east winds prevailed. The highest temperature registered in the shade was 71° on the 19th; the lowest was 51° on the 28th. The vicissitudes to which our climate occasionally exposes us have seldom been more strikingly exemplified than in the great contrast which has existed between our recent weather and that of last summer. No wonder half-hardy plants, natives of sunny climes, looked so miserable, when the

records of bright sunshine were not half of what they were last year. Fruit on all our deciduous trees was stunted-looking. Nothing amongst hardy plants looked vigorous, except the very hardy herbaceous plants, and many of these were late to bloom. The rainfall was very heavy.

August was another dull, cold month, the mean temperature being low throughout. The highest reading in the shade during the day was 67°, the lowest 52°. The night temperature was also low, having been frequently below 40°. On the corresponding month last year we were lamenting over the deficiency of rainfall, and the extent to which hardy plants were suffering from the drought. The opposite is the case this year. Half-hardy plants made considerable growth, but the prospect of obtaining cuttings sufficiently matured for propagation was still poor. Owing to the frequent rains and spring-like weather many hardy shrubs pushed second growth. The past summer will long be remembered for its low temperature, absence of sun-heat, cold drenching rains, and the gloomy prospects felt generally regarding the ripening of cereal, root, and fruit crops of all kinds.

September was a fine month, and counteracted to a large extent the worst forebodings of the backward summer, for a finer autumn month has rarely been known in this part of the country. The rainfall was light and the temperature high. On the 14th 103° were registered in the sun. Dahlias, Heliotrope, Pelargoniums, etc., were blooming as they should have done in July and August. A better supply of cuttings were secured than was expected, but the good season came too late for the perfect ripening of such seeds as we are accustomed to save here.

October, with the exception of the last six days, was a fine month, with the temperature above the average, 50° to 60° being frequently registered in the shade. The lowest night-reading was 30°, or 2°

of frost, during the night of the 6th. The congruity of the season has been such as to induce a second growth, particularly on hardy Rhododendrons, which are in consequence very deficient of bloom buds. As indicating the mildness of the weather at the end of the month, good Mignonette and fairly good single Dahlias were still in bloom on the open borders. Abnormal growth on many plants, and even bloom on fruit trees, are reported from many parts of the country. The rainfall was again very light.

November, up to and including the 12th, was fine and dry, but with a considerable supply of cold north winds. On the night of the 12th rain began to fall, and the weather became gradually worse until the night of the 15th, when we experienced a violent storm, which continued with more or less severity the following day, doing great damage to property and uprooting trees in many places, particularly where exposed to the south-west. Professor Grant, Glasgow Observatory, records that the wind was blowing with a velocity of 68 miles an hour. The maximum pressure registered by Osler's anemometer amounted to 29 lbs. on the square foot. Since the above date the rainfall has been heavy, and gales of considerable severity have been frequent. The thermometer was at or below the freezing point six times. The lowest reading was 29°, or 3° of frost. The total record was only 10°.

During December frost was registered on twelve nights, the lowest reading being 19°, or 13° of frost, during the night of the 29th. Nine degrees were also registered on the night of the 30th. Otherwise the readings were light, 44° being the total for the month. On most days the mean temperature was high, inducing Wallflower and forms of the common Primula to flower prematurely. Yet the season has had its advantages, for a finer for planting or transplanting hardy trees or shrubs could not be desired.

The following is a statement of the monthly record of barometric readings, rainfall, and sunshine

for the year 1888, as registered at the Glasgow University Observatory by Professor Grant:

| | BAROMETRIC READINGS. | | | RAINFALL. | | SUN-SHINE. |
|---|---|---|---|---|---|---|
| | MEAN. | HIGHEST READING. | LOWEST READING. | INCHES. | NO. OF DAYS ON WHICH RAIN FELL. | REGD. DURATN. |
| | Inches. | Inches. | Inches. | | | Hours. |
| January, | 30·126 | 30·696 | 28·969 | 2·812 | 14 | 30·9 |
| February, | 30·061 | 30·597 | 29·365 | 0·708 | 13 | 57·1 |
| March, | 29·639 | 30·522 | 28·848 | 3·136 | 16 | 89·1 |
| April, | 29·880 | 30·329 | 29·252 | 1·972 | 16 | 94·8 |
| May, | 29·941 | 30·557 | 29·000 | 3·223 | 14 | 177·8 |
| June, | 29·958 | 30·369 | 29·421 | 2·420 | 13 | 212·8 |
| July, | 29·727 | 30·079 | 29·236 | 4·976 | 22 | 93·9 |
| August, | 29·897 | 30·287 | 29·347 | 2·138 | 20 | 132·7 |
| September, | 30·139 | 30·531 | 29·646 | 1·275 | 13 | 90·1 |
| October, | 29·941 | 30·498 | 29·123 | 1·695 | 11 | 60·0 |
| November, | 29·675 | 30·106 | 29·015 | 4·832 | 21 | 14.7 |
| December, | 29·799 | 30·423 | 28·920 | 3·585 | 20 | 15·7 |
| YEAR, | 29·899 | | | 32·772 | 193 | |

IV.

# *NOTES ON THE FLORA OF BARRA AND SOUTH UIST.*

BY ALEX. SOMERVILLE, B.Sc., F.L.S.

[Read 26th March, 1889.]

At the meeting of the Society in December, 1887, I had the pleasure of reading a paper entitled "Notes on the Flora of the Island of Barra," giving results of botanising during a week spent in Barra in the month of July of that year, when some fifteen flowering plants, not previously recorded as growing in the Outer Hebrides (Watsonian Vice-County No. 110), had been met with.

Last July (1888) I had the opportunity of revisiting the same quarter, and of spending one week in Barra and another in the southern or Lochboisdale end of the Island of South Uist. Before starting I was placed under great obligations by our Corresponding Member, Mr. Arthur Bennett, F.L.S., who was good enough to furnish me with a copy of the eighth edition of the *London Catalogue of British Plants*, in which he had marked all the species known to grow in the Outer Hebrides. With this in hand I was set free to devote attention to species unmarked, which the list left me to understand had not previously been recorded, and I had arranged to make thrice-weekly despatches to Mr. Bennett of living specimens of unmarked plants, in order that he might for himself see and examine them in the fresh state.

In my former paper I referred to the physical features of Barra, and need not consequently dwell on these here. Barra presents great variety of

situation, and affords no little field for botanical search. My explorations on this occasion were confined chiefly to its western side, to the slopes leading down to the rocky seashores, and to the high grass-grown cliffs at Tangusdale, a short distance inland, the exposure of which is to the north-west. While in Barra I received a letter from Mr. F. J. Hanbury, F.L.S., editor of the last edition of the *London Catalogue* (and in whose company I had the pleasure, a month later, of making the ascent of Ben Lawers), asking that I would secure for him specimens of all the *Hieracia* I could meet with, for use in connection with the illustrated Monograph of the British *Hieracia*, on which he is now engaged. He also requested that before drying any specimens I might collect for him, I would note particularly the colour of the styles and the form of the involucre.

On the cliffs alluded to, *Hieracia* were in abundance; and specimens which were taken and pressed have since been transmitted through Mr. Bennett to Mr. Hanbury, who has so far determined from among them the following four species, viz.: *Hieracium anglicum*, Fries, *H. argenteum*, Fries, *H. murorum*, L., form, and *H. scoticum*, F. J. Hanbury.

On the same cliffs the grass *Brachypodium sylvaticum*, R. and S., occurred, also the Scotch Burnet Rose (*R. spinosissima*, L.).

The elegant-leaved *Trifolium medium*, L., was observed in various parts of the island, both inland and at the edges of rocky banks overhanging the sea. In the latter situation the plants, though not tall, were luxuriant, and the terminal heads, which both Hooker and Hennedy describe as "shortly peduncled," had in some cases a peduncle of two inches.

Among Cyperaceæ, one of the most plentiful was *Schœnus nigricans*, L., found in especial abundance on the southern slopes leading down to the Sound of Vatersay.

On the northern exposure of the Doirlinn promontory, the Vernal Squill (*Scilla verna*, Huds.), referred to last year, was in plenty at the edges of the heather.

On grass-grown sand-hills swept by the winds, and where everything green was in a more or less dwarfed condition, *Viola Curtisii*, Forst., bloomed at our feet; while here and there was to be seen a peculiar stunted form of *Galium verum*, L., presenting the appearance of a small juniper plant. This form Mr. Bennett tells me he has also seen on the sand-hills of Norfolk.

Between Barra and South Uist lies the island of Eriskay, three miles in length, the inhabitants of which, a few years ago, suffered so severely from an epidemic of measles. On this island there grows a plant with some interest attaching to it. Miss C. F. Gordon Cumming, the well-known authoress, refers to it at page 305 in her book, *In the Hebrides*, in the following words: "For those who love wild flowers these islands offer various treasures. For instance, in the rocky Isle of Eriskay, in Barra Sound, a lovely blue flower, something like a Convolvulus, with waxy leaf, blooms in July and August. As it is unknown elsewhere the people account for its presence by saying that Prince Charlie brought some seeds from Normandy and sowed them here in some idle moment in those summer days which he spent here, when, in July, 1745, he arrived with one small frigate of sixteen guns, with a little handful of faithful adherents, to reclaim the crown of Britain." Through the courtesy of Mr. Malcolm Macleod, whom I met on his way to Eriskay, I was favoured with fresh specimens of this plant, which proved to be *Calystegia Soldanella*, R.Br., not previously recorded from the Vice-County, and which does not seem to have come under the notice of Professors Balfour and Babington in their visit to the Hebrides in 1841. The circumstance of the plant growing on this little island, while an examination of the

western shores of Barra and South Uist failed to discover it there, is somewhat remarkable, the more so that there is no reliable record of it from anywhere further north than the Mid-Ebudes, the island group which includes Mull, Coll, and Tiree.

I wrote to Miss Gordon Cumming, telling her what the interesting plant proved to be; and in acknowledging my letter she says: "It is nice to know the truth about the blue Convolvulus of Eriskay, even though I fear we must now give up the pretty story of its seeds having been brought by Prince Charlie!"

The physical features of South Uist, which was visited after Barra, call for some remark. The island lies north and south, and is twenty-five miles long by some five miles broad. It may be said to be divided into three very unequal longitudinal belts. The eastern, which occupies three-fourths of the width of the island, is the mountainous one, where we find Ben More (1,994 ft.) and Hecla (1,988 ft.), and where there is much bleak moorland. Immediately to the west of this, running through most of the island, is the marshy belt in which are situated the shallow lochs which bring so many fishers in summer and autumn to Lochboisdale Hotel. The third belt—the most westerly, and at the same time the narrowest—which lies along the Atlantic shore, is of light land, whose sand-hills and shifting soil give evidence of its having been reclaimed from, as well as made by, the ocean.

These three belts are each possessed of a flora more or less distinct, and furnish, as does Barra, a large variety of situation, from which, however, woodland is again entirely absent.

The mountains of the Outer Hebrides are reputed to be botanically poor, and to possess but few of those plants which characterise the flora of the higher elevations on the mainland. With this the Laurentian gneiss rock-formation and the salt breezes of the Atlantic have no doubt largely to do. On

the eastern and more sheltered side of this mountainous belt, facing across the Minch to the Island of Skye, occur deep ferny dells, such as attract the Woodcock in large numbers in winter. In one of these dells *Rubus Idæus*, L., *Ajuga reptans*, L., and several other unrecorded plants are found growing. On a steep bank at some elevation inland, and among a rank growth of grass and woodrush, we unexpectedly came on *Allium ursinum*, L., and on a wet grassy path at a lower level *Scutellaria minor*, L.; while along the rocky northern shore of Lochboisdale are to be seen *Lycopus europæus*, L., *Œnanthe crocata*, L., *Agrimonia Eupatoria*, L., *Polygonum Bistorta*, L., and other additions to the known flora of the district.

The marshy belt of South Uist I had the opportunity of exploring during short visits paid at Askernish to Mr. Paterson, factor to Lady Gordon Cathcart, and at Bornish, a little further north, to Mr. John Ferguson, a large farmer, near whose house there was being carried on by crofters the manufacture of kelp from seaweed brought ashore by Atlantic storms.

The vegetation in the marshes and around the lochs of this belt was rich and varied. The early part of last summer seems to have been drier in these outer islands than in many parts of Scotland, and of this there was evidence in my being able to walk over tracts usually impassable in July. The poisonous *Cicuta virosa*, L., was a surprise to meet with in plenty along the edges of one loch, while several species of *Ranunculus* and *Potamogeton* were in luxuriance in the channels which drained the district.

The sandy belt in South Uist was found to be no less rich in brilliant colouring than that in Barra. Here *Viola Curtisii*, Forster, was in great abundance, also a large succulent-leaved form of *Polygala*, while *Lithospermum arvense*, L., was common in the sandy potato-fields close by. Little above high-water mark,

near Daliburg, we came on *Eryngium maritimum*, L., which, notwithstanding its conspicuous appearance, had not been noticed by Balfour and Babington.

During my stay in the Outer Hebrides, comparatively short though it was, I succeeded, by the aid of the marked list referred to, in obtaining some 49 species of vascular plants not previously known to occur in these islands.

To these species I might more particularly refer but for the fact that Mr. Bennett has been so good as to write a short paper on them.* I will not, therefore, do more here than express warm thanks to that gentleman for his kindness in rendering the aid he did in carefully comparing and determining, immediately on receipt of them, the plants which were sent to him, and in his having drawn up the paper alluded to, which cannot but prove a valuable contribution to the *Transactions* of the session.

* See page 37.

V.

# *NOTES ON THE FLORA OF THE OUTER HEBRIDES.*

BY ARTHUR BENNETT, F.L.S.

[Read 26th March, 1889.]

In laying before the Natural History Society of Glasgow a few notes on the plants of the Watsonian Vice-County No. 110, I wish at the commencement to say that I do not pretend to search out or exhaust the material that has accumulated since the well-known journey of Messrs. Balfour and Babington in 1841. In fact, had not my kind correspondent, Mr. A Somerville, urged me to send these notes, I should not have thought of doing so; and it is to him that whatever additional information there may be is due. The author of some future Flora of these islands must search out and collate the information scattered in various publications. As it is, I will merely indicate here those that have come under my own eyes when making notes.

T. Pennant, *Tour in Scotland and Voyage to the Hebrides,* 1774-6, with figures of plants.

W. Macgillivray, in *Edinburgh Journal of Natural and Geographical Science,* 1830, p. 91.

J. H. Balfour and C. C. Babington, in *Transactions of the Botanical Society of Edinburgh,* vol, i., and *Annals and Magazine of Natural History,* 1841.

Dr. Stirton, in *Scottish Naturalist,* 1886, p. 182.

Arthur Bennett, ,, ,, 1887, pp. 56-66.

Arthur Bennett, ,, ,, 1888, pp. 247-261.

In 1841 Balfour and Babington gave the number of plants for these islands as 311 species of flowering plants and higher cryptogams. Up to the present date they may be stated at 416; but as Mr. Somerville

last year added 50 species, it is evident that the flora is by no means exhausted. Looking to those occurring in the whole group coming under the Inner Hebrides (Watsonian Vice-Counties 102, 103, and 104), which I suppose may now be fairly stated at about 630 species, I consider that we may expect that the Outer Hebrides have yet some 80 to 100 species to be recorded. This may appear too high an estimate, especially if we look to the decided diminution in the number of species that occur from east to west in Scotland; though personally I believe that this decrease has been overstated and the records for the last four years from the West of Scotland seem to me to confirm my view.* Anyone who will compare the records for the three groups into which Watson has divided the Inner Hebrides will at once see what a decided falling off there is between 104 (North Ebudes) and 102 (South Ebudes); if the relative difference between these two be equally divided, it will be found that it fairly represents the plants that occur in 103 (Mid Ebudes). This, of course, is from north to south, but a difference can even be found in those from east to west. With regard to the Outer Hebrides and the other North Isles (*i.e.*, Orkney and Shetland), it is to be regretted that at the time when Watson divided his provinces, etc., there was not sufficient information to separate the Hebrides from the other "North Isles," as he terms them. One thing can only be remarked on this: the flora of the Shetlands is of a much more northern (or even Arctic) character than that of the Outer Hebrides, and Balfour expresses his surprise at the small number of alpine plants gathered by him in 1841.

There are two others which I suppose may fairly be considered as belonging to the Outer Hebrides, *i.e.*, St. Kilda and Rona. On the former island my friend Mr. Barrington found several plants hitherto unrecorded for that distant group, and several also

*On this see S. Grieve in *Trans. Edin. Bot. Society*, 1887, pp. 487-490.

on North Rona, which is uninhabited. These will be found recorded in the *Scottish Naturalist*, and also by Mr. Barrington himself in the *Journal of Botany* for 1886, pp. 213-216.

It should be noted that Balfour and Babington spent most of their time in Lewis and North Uist. Mr. Somerville's records are from South Uist and Barra, indicated respectively by the letters "S.U." and "B." after the names in the following list:

Ranunculus Drouetii, Godr.—B.
 Baudotii, Godr.—S.U.
Fumaria confusa, Jord.—S.U.
 officinalis, Linn.—S.U.
Nasturtium officinale, R. Br.—B. and S.U.
Cochlearia danica, Linn.—B.
Viola Curtisii, Forster.—B and S.U.; western sandy belt of islands.
Polygala eu-vulgaris, Linn.—S.U.
Spergula arvensis, Linn. var. sativa (Boenn).—B.
Spergularia neglecta, Kindb.—B.
Geranium dissectum, Linn.—S.U.
Trifolium medium, Linn.—B.
 minus, Sm.—B.
Agrimonia Eupatoria, Linn.—S.U.
Rubus Idæus, Linn.—S.U.
 polyanthemos, Lindb. (*R. umbrosus*, Bab.)—S.U. Determined by Mr. J. G. Baker, who says this is the oldest name for this bramble. In the 8th edition of the *London Catalogue* it is referred to *R. Maasii* of Focke, but Mr. Baker doubts this reference.
Rosa mollis, Sm.—S.U.
 spinosissima, Linn.—B.
 canina, Linn., var. dumalis (Bechst.) forma glaucophylla, Winch.—B. Mr. Baker confirms this name.
Lythrum Salicaria, Linn.—S.U.
Epilobium obscurum, Schreb.—S.U.
Eryngium maritimum, Linn.—S.U.
Cicuta virosa, Linn.—S.U. Marshy loch named "Loch na Liana Moire," where it was plentiful, the dry time allowing Mr. Somerville to collect it. Mr. Somerville remarks that the farmer, on whose land it was, did not seem aware of its highly poisonous nature. An interesting addition to the flora of the islands. The nearest record to the islands seems to be the County of Dumbarton.
Helosciadium nodiflorum, Reich.—B.
Œnanthe crocata, Linn.—S.U.

Hedera Helix, Linn.—B. On rocks on hill-side. Watson thought that 110 might be an exception to its general distribution, but Mr. Somerville had no doubt of its being wild and indigenous.

Galium uliginosum, Linn.—S.U.

Sherardia arvensis, Linn.—S.U.

Valerianella olitoria, Mœnch.—B.

Arctium minus, Schk.—B.

Chrysanthemum Leucanthemum, Linn.—B.

Gnaphalium uliginosum, Linn.—B.

Hieracium anglicum, Fries.—B.

argenteum, Fries.—S.U.

murorum, Linn. (forma)—B.

scoticum, Hanbury.—B.

Convolvulus Soldanella, R. Br.—Eriskay Island.

Scutellaria minor, Linn.—S.U.

Lycopus europæus, Linn.—S.U.

Ajuga reptans, Linn.—S.U.

Anchusa arvensis, Bieb.—S.U.

Samolus Valerandi, Linn.—S.U.

Atriplex arenaria, Woods.—S.U. Specimen young but apparently of this species. Mr. Somerville was unable to obtain more mature specimens.

Polygonum Bistorta, Linn.—S.U.

Corylus Avellana, Linn.—S.U. Mr. Watson remarks: "In the Hebrides the Hazel has perhaps been introduced again, after having become extinct there." This referred to Balfour and Babington's station of "Rhoddal, in Lewis," which was admitted to be a very doubtful one; but Mr. Somerville's locality—"a number of bushes on the rocky banks overhanging the sea near Lochboisdale in South Uist"—seems to be an undoubtedly wild one.

Myrica Gale, Linn.—B.

Lemna minor, Linn.—S.U.

Potamogeton heterophyllus, Schreb.—B.; a scrap only among other aquatics, but referable to this species.

"mucronatus, Schrad."—S.U. The distribution of this plant is somewhat like that of *Cicuta*, its nearest station known to me being in Dumbarton, whence I have specimens gathered by Mr. Gibson.

pectinatus, Linn.—S.U. The typical plant of Symes *English Botany!*

Orchis incarnata, Linn.—B.

Allium ursinum, Linn.—S.U. In *Topographical Botany*, 2nd Edition, this is recorded for the North Ebudes (Skye) in 1883. Since that date I have seen specimens from the Hebrides, East and West Sutherland, and Caithness.

Scirpus Savii, Seb. and Maur.—B. A local species in Scotland, whence I have seen it from Wigton, Ayr, Clyde Isles, Cantyre, South Ebudes, Mid Ebudes, and the Hebrides.

Malaxis paludosa, Sw. — Mr. T. A. Cotton gathered several good specimens of this on the Island of Harris, where he also found the white variety of *Erica cinerea.*

Chara fragilis, Desv.—S.U.

aspera, Willd.—S.U.

hispida, Linn.—S.U. "Approaching *C. papillata,*" *fide* Groves.

Nitella batrachosperma, A. Br.—Loch near Obbe, Isle of Harris, July, 1888; Mr. W. S. Duncan, com. Mr. F. C. King. A species new to the British Flora.

In addition to the new records referred to, Mr. Somerville gathered about eighty species, most of which were found in the other islands by Messrs. Balfour and Babington. *Ophioglossum vulgatum,* Linn., was found on North Rona by Mr. Barrington, and on Benbecula by Dr. Stirton, along with *Osmunda regalis,* Linn., and *Potamogeton filiformis,* Nolte. The Characeæ are the first that have been authentically recorded from the islands.

VI.

# ISOCARDIA COR, *L., IN THE WEST OF SCOTLAND.*

BY ALEX. SOMERVILLE, B.SC., F.L.S.

With one Plate [I.].

[Read 30th October, 1888.]

THE marine bivalve mollusc *Isocardia cor*, L., is the only British species of the eccentric genus to which it belongs. The recent *Isocardiæ* (including the section *Meiocardia*) known to science number some five only, their distribution being the Scandinavian and British seas, the Mediterranean, and the seas of China and Japan. In fossil times *Isocardiæ* were more plentiful, both in kind and number, than now; for we find some 90 species in all, which have been referred to this genus, scattered through various formations from the Lias downwards to the Crag and other Pleiocene strata.

*Isocardia cor* is certainly a shell of exceptional appearance, its cordate-globular form rendering it both striking and elegant. It differs from the shells of all the other 160 lamellibranchs that inhabit British seas, in that while they (including the only other species of the family to which *Isocardia* belongs, viz., *Cyprina islandica*, L.) have the umbones or beaks simply incurved in the usual manner, the beaks of *Isocardia* are considerably apart, gracefully recurved, and, indeed, so spirally twisted as to form a nearly complete whorl. Linnæus called the shell at first *Cardium humanum* from its resemblance to the human heart, then *Chama cor*;

ISOCARDIA COR, L.

($\frac{2}{3}$ *nat. size*)

but it is by the name bestowed on it by Lamarck that we now know it. So suggestive is the shell of the form of a heart, that generic and specific names, both relating to that object, have been given to it—the former being from the Greek, the latter from the Latin. In France, as Jeffreys tells us, the shell is called "cœur-de-bœuf," or ox-heart, and in Holland "zots-kappen," or fool's cap.

*Isocardia* cannot be said to be generally distributed in British seas. The only locality where it has hitherto been frequently obtained is in deep water off the east coast of Ireland, out from County Dublin, where it is taken by trawlers. Here it is met with fixed in the mud, having (as is to be gathered from its behaviour in a vessel with sand and sea-water) its umbones or beaks covered by the mud, and little visible but the orifices of the mantle-tubes directed upwards. Placed thus, and every now and then contracting its powerful adductors, it brings the valves of the shell together with a jerk, creating a current, and slowly sifting out of the water the microscopic organisms which form its food.

In addition to the quarter referred to, *Isocardia* is also met with off the south coast of Ireland, where Bantry Bay and the Cove of Cork are given as localities. In Britain, Forbes and Hanley report it from off the Cornish coast, and it has also been met with in the West of Scotland, though very sparingly.*

It is a rather remarkable circumstance that though valves and fragments of *Isocardia* have at times been dredged in the Clyde estuary, never till during the summer of last year were specimens obtained in the living state. Canon Norman, some thirty years ago, as is recorded in the pages of the *Zoologist* (1857-60), met with two or three single valves in deep water between the Cumbraes; but so little store was set by this fact, that Mr. Alfred Brown, in his *Mollusca of the*

* Since this paper was read, *Isocardia cor*, L., has been take alive by Mr. Thomas Scott in the Moray Firth

*Firth of Clyde*, published in 1878, accounted for these valves on the supposition either that they had, like *Pecten islandicus* when it occurs with us, been washed out of a post-tertiary bed, or that they might have been thrown overboard from some fishing-boat returning from the Irish coast.

The next reported occurrence of the shell was by myself. In dredging, in 1878, in 20 fathoms at Portavadie, opposite Tarbert, in Loch Fyne, there came up a fragment of which the unmistakable umbo or beak formed a part. This fragment was shown both to Mr. David Robertson, our President, and to Mr. Alfred Brown, and was admitted by them to be a piece of *Isocardia cor.*

The next record is by Dr. J. R. Henderson, now Professor of Biology in the Christian College, Madras. In the *Scottish Naturalist* of January, 1885, he tells us that while trawling in the *Medusa* in 1884, in 20 fathoms off the north end of Holy Island, Arran, there were brought up one or two examples of this shell, perfect and fresh, but without the animal; and he also subsequently obtained valves in 60 fathoms water, at some distance from Whiting Bay.

It was rather remarkable that these examples should have been met with, for Prof. Herdman, who worked about Holy Island for a month in the autumn of 1879, and whose carefully drawn-up lists of all the Invertebrate groups were laid before the Royal Physical Society on 21st January and 15th December, 1880, makes no reference to *Isocardia.*

The next Clyde record is of especial interest, as it is the one which at last established *Isocardia* as a denizen of our own estuary, the previously-obtained untenanted dwellings of the animal not sufficing to do that. At a meeting of this Society in August of last year, a short paper by Mr. David Robertson was read which described the obtaining of living specimens of *Isocardia* in from 90 to 98 fathoms water, between the Cumbrae Lighthouse and Brodick, on a bottom of soft mud. These were obtained at two

different hauls of the dredge, which at the time was being worked from the *Medusa* under the direction of Dr. John Murray of the *Challenger*. The first haul brought up two large specimens, one being full-grown, and both having the rich brown epidermis possessed by the species; while the second haul produced three small specimens, one of which was an inch in diameter, and another no bigger than a pea.*

The next occurrence of *Isocardia* to which I have to refer is that of a live example dredged by myself last month in 32 fathoms, on a muddy bottom, in the Firth of Lorn, a short distance out from the Maiden Isle, near Oban, and at a spot where I had an unexampled take of the bivalve *Lima elliptica*, L., no fewer than 125 living specimens having been obtained in three hauls of the dredge. Observing in the mud which had been emptied into the sieve a little mud ball, as it appeared to be, of some consistence, I washed it carefully, and was surprised to find it to be a young and beautifully mottled living specimen of *Isocardia*.

In reply to a letter written to Dr. John Murray regarding the capture, that gentleman informed me that on the day he wrote (3rd October) he had dredged from the *Medusa* a number of dead specimens of *Isocardia*, in the Firth of Lorn, in 80 to 100 fathoms; and later he wrote: "A live specimen was dredged on Tuesday last by the *Medusa* in the Firth of Lorn."

It may be mentioned that there are in the possession of Mr. W. Anderson Smith, of the Scottish Fishery Board, two large and perfect specimens of *Isocardia* which were dredged by him a few years ago in Loch Creran, in water of only some 10 fathoms depth. These, however, were dead when obtained. An account of the dredging of these

* The adult specimen referred to, which had been presented by Dr. Murray to the Duke of Argyll, was most kindly lent by His Grace for exhibition at the meeting of the Society on 30th October, 1888, at which the present paper was read.

specimens is given in Mr. Smith's well-known book *Benderloch.*

*Isocardia cor* is reported to have been also met with off Iona, but, be this so or not, the species is evidently of more frequent occurrence in the Firth of Lorn and its tributary lochs than has been supposed. Dr. Murray, indeed, says: "I do not think they (*Isocardiæ*) are at all so very rare in the deepest holes around our western coasts."

As to our own estuary, it is remarkable that although the Clyde, as we are aware, has for forty years been a favourite and well-worked dredging-ground, it was not until fourteen months ago that this large organism was ascertained to have a habitat in the waters that wash our own immediate shores.

VII.

# *NOTICE OF THIRTEEN CUMACEA FROM THE FIRTH OF CLYDE.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

[Read 26th February, 1889.]

ALTHOUGH the Cumacea of the Firth of Clyde and West of Scotland have been almost wholly overlooked, this neglect cannot have arisen from their want of attractions, for they are a most interesting group of little crustaceans, or from their scarcity, for they are met with from low-water to all depths of the Firth of Clyde, in mud, sand, and gravel, as well as plentifully between tide-marks in all our sandy sheltered bays. Those species that inhabit the sand burrow into it, not straight downward with their head foremost, but by wriggling into it, much in the manner of the flounders, crabs, and such amphipods as *Bathyporeia pilosa*, etc. Others are found between tide-marks adhering to stones, and some are also met with in the surface-net, chiefly after sunset.

The value of the following short list has been greatly increased by the species having been all submitted to and identified by the Rev. Canon Norman:

## Class CRUSTACEA.

## Order CUMACEA.

### Cuma scorpioides Montagu.

Taken in surface-net after sunset; depth 4-5 fathoms, Blackwaterfoot, Arran.

**Iphinoe trispinosa** Goodsir.

Taken plentifully in Kames Bay, Millport, a little beyond low-water, and in the surface-net at Millport and Lochranza. The Rev. Canon Norman informs me that the immature males of this species with finets not fully developed (*i.e.*, not plumose) have spines over the back of the carapace, but he has never seen a fully developed male with such spines at the last month before maturity, as they seem always to be lost before that stage is reached.

**Cumopsis lævis** G. O. Sars.

Taken in sandy bay, Millport.

**Lamprops fasciata** G. O. Sars.

Taken at low-water, Hunterston, opposite Millport, and plentiful at the west side of Helensburgh pier.

**Eudorella marginata** Kroyer.
*Cyrianassa ciliata* Norman, *mas.*

Dredged in Rothesay Bay, 12 fathoms, bottom shells and mud.

**Diastylis rugosa** G. O. Sars.
*D. strigata* Norman, *mas.*

Taken in Lochranza in black sandy mud, 5 fathoms, and in 20 fathoms at Blackwaterfoot.

**Diastylis tumida** Lilljeborg.

Dredged at Blackwaterfoot in 20 fathoms, bottom light-coloured muddy sand.

**Diastylis lævis** Norman.

Dredged at Blackwaterfoot in 20 fathoms, bottom light-coloured muddy sand.

**Diastylis biplicata** G. O. Sars.

Taken with the above.

**Diastylis spinosa** Norman.
*D. bimarginata* Bate.

Taken at Blackwaterfoot in 20 fathoms, and at low-water west side of Helensburgh pier.

### Pseudocuma cercaria Van Beneden.

*Cyrianassa longicornis* Bate, *mas.*

Plentiful in Kames Bay, Millport, and a little beyond low water. The females are more plentiful than the males.

### Cumella pygmæa G. O. Sars.

*C. agilis* Norman.

Taken plentifully at low water. Cumbrae; Isle of Man; and Shetland.

### Nannasticus unguiculatus Bate.

*N. binoculoides* Bate, *mas.*

The female of this species has been taken by me chiefly at the roots of *Laminaria saccharina*, and only one or two at a time. Lately I found the male on stones near low water in the small bight on the east side of Kames Bay, Cumbrae, called Portloy, where they were moderately common on the mud or small algæ that covered the stones. They were mostly found stretched out at full length, with the caudal appendages spread out. When removed from the stones and put into a vessel with clean water, they seemed to make little or no progress either in walking or swimming, but appeared rather inclined to lie with their tail pushed below their body and out under their head. They are sluggish, and when taken make no attempt to escape, but seek rather to maintain such hold as they may have on the stone. They are always covered with mud which is difficult to remove. The male of this species has two eyes, and the female but one.

VIII.

# *THE DISPERSION OF SEEDS AND SPORES.*

BY REV. ALEX. S. WILSON, M.A., B.SC.

## *PART I.*

[Read 25th September, 1888.]

THE geographical range of any species of plant, as well as the continuance of the species, depends, in large measure, upon the power of the plant to distribute its seeds over a wide area. As the earth is already everywhere stocked with vegetation, no openings are available for developing seeds save those which death annually causes in the ranks of vegetable organisms. Only a limited number of recruits, so to speak, is required every year to keep up the strength of Flora's regiments, and for every vacancy there is a spirited contest among the numerous candidates. So vast, indeed, is the number of seeds produced by plants in comparison with the numbers attaining maturity, that the struggle for existence is probably nowhere keener than among seeds.

Any peculiarity about a seed, then, which favours its chance of finding an appropriate spot in which to germinate, must be of the very highest importance in relation to the life of the species. The arrangements for facilitating the transport of seeds present considerable variety, and offer one of the most inviting fields of research in botanical science. In order to make our survey as comprehensive as possible, it will be necessary to include the means

by which dispersion is effected in the case of flowerless plants. These, it is true, are not propagated by seeds, but by spores. The nature of the body to be dispersed is, however, of secondary importance, and the functions of seeds and spores are so much alike that we may, for the present, neglect this distinction. Indeed, one feels very much, in pursuing such an investigation as the present, how desirable it would be to get rid of the terms "flowering" and "flowerless" altogether. It would certainly conduce to clearness if we could discard entirely the artificial distinction between Phanerogams and Cryptogams. The distinction disappears when we remember that a flowering plant may be regarded as simply one of the higher Cryptogams producing like *Selaginella* two kinds of spores—the pollen-grain corresponding to the microspore, and the embryo-sac to the macrospore.

We are familiar with many contrivances for securing the distribution of pollen-grains in order to cross-fertilisation. These present so close an analogy to the provisions for the dispersion of seeds, that it is well to consider both together. We have therefore here to concern ourselves with distribution in the widest sense. The bodies dispersed may differ in structure and morphological value, but the means of transport are very much the same. The body dispersed may be as follows:

1. The entire plant: *Protococcus*, *Bacteria*, etc.
2. A bud or branch: *Marchantia*, Swan's-neck moss.
3. A vegetative cell: spores of ferns, fungi, etc.
4. The sperm or male sexual cell: antherozoids, microspores, pollen-grains.
5. The germ or female cell: macrospores of *Selaginella*, *Isoetes*, etc.
6. The fertilised germ or embryo: exalbuminous seeds.

A seed is simply an embryo invested by a portion of the mother plant. In this covering three layers may usually be distinguished: the nucleus, the

tegmen or inner integument, and the testa or outer integument of the seed. The portion of the seed dispersed may therefore be—

7. The nucleus enclosing the embryo.
8. The nucleus enveloped by the tegmen: *Oxalis.*
9. The complete seed.

In like manner the body dispersed may include part of the fruit. The seed may be enclosed in—

10. The endocarp: drupaceous and stone-fruits.
11. The endocarp and mesocarp.
12. The entire pericarp.

In this last case the fruit rather than the seed is dispersed. Even the fruit is sometimes accompanied by accessory parts—calyx, corolla, receptacle, etc.; while in splitting-fruits the seed is enclosed within a section only of the fruit.

In every species of plant there is produced one set of bodies intended for distribution. This is sufficient where no necessity exists for fertilisation. So long as continued vegetative reproduction does not lead to degeneration, the perpetuity of the species may be secured by the distribution of one set of germs. But when the necessity arises for sexual reproduction, the arrangements for distribution become more complicated. In general, we may assume that where true sexuality exists a twofold dispersion is requisite or at least advantageous. In the first place, the male element or sperm cells must be so disseminated as to insure the fertilisation of as many germ cells as possible. Secondly, provisions are required for the dispersion of the fertilised germs.

When the problem is thus stated it will be seen at a glance that the dispersion of the male element (antherozoid, microspore, or pollen-grain, as the case may be) is of greater urgency than even the distribution of the fertilised germs. Accordingly, we find that the contrivances for distributing the male cells are, on the whole, far more perfect than the arrangements for dispersing the products of

fertilisation. Plants in which vegetative reproduction alone occurs, and those in which adjacent cells conjugate, might be designated (1) *Isosperms*, since only one set of bodies requires dissemination to secure the perpetuation of the species. Those, again, requiring separate distributions of sperm and germ-cells might be termed (2) *Heterosperms*. Even a double distribution would be insufficient for those parasitic fungi which, like *Puccinia*, spend part of their existence on one host and another term on a different plant. Some of these produce five or six different kinds of spores—æcidiospores, uredospores, telutospores, sporidia, spermantia, etc. In such cases probably three or more distinct and separate distributions or sowings of reproductive bodies may be necessary in order to complete the life-history of the species. These we may provisionally term (3) *Polysperms*.

The nature of the bodies dispersed, whether they be fertilising or fertilised cells, vegetative or resting spores, does not so much concern us at present as the provisions for securing dispersion. Before considering the various agencies by which the distribution of plant-germs is effected, we have to note two general characteristics of all vegetable reproductive bodies, viz., (1) Size and (2) Number.

(1) The first evidence of adaptation for wide distribution is size. The chances which a minute body has of being carried to a distance are infinitely greater than those of a large body. Hence, in general, the small size of spores and seeds. So minute are the reproductive bodies of many organisms that they have hitherto defied the powers of the microscope. The contents of the ripe seed-capsule of the orchid resemble snuff. Similar spore-like seeds occur in many epiphytes and parasites such as *Rafflesia*. The minute size of pollen-grains facilitates their dispersion. The superior adaptation of the pollen-grain in relation to distribution is seen when we compare its size with the seed or

even with the embryo-sac. In like manner, the small size of the microspores in comparison to the large macrospores of *Selaginella* and other heterosporous cryptogams is explained by the greater necessity for dispersing the male element. The minuteness of the antherozoids of Ferns, Horsetails, Mosses, etc., is also determined in relation to their dispersion.

(2) The distribution of a plant also depends on the number of seeds or spores to which it gives rise. Bodies intended for wide distribution must be produced in large numbers. Here, again, the adaptation in seeds, and especially in spores, is very obvious. A single plant of *Sinapis nigra* has been known to yield 8,000 seeds, a single poppy 60,000; Darwin computed that an orchid might yield 12,000,000; while the number of spores produced by any ordinary Fern or Fungus defies computation.

We may also note here the much greater abundance of male than of female cells. The antherozoids of any plant far exceed in number the oöspheres to which it gives rise. The pollen-grains, again, far outnumber the ovules; and in wind-fertilised plants like the Pine, which throws out clouds of pollen, the numbers are out of all proportion.

Seeds, as a rule, are larger bodies than spores, and produced in much less profusion. This inferiority in relation to dispersion explains why Phanerogams are generally much more limited in their geographical range than Cryptogams. The larger size of seeds also renders necessary special adaptations in form and structure which are not met with in the spores of flowerless plants.

Dispersion may be effected by any of the following means:

1. The locomotion of the plant itself;
2. The vital activity of the germ;
3. Hygroscopic action and Turgescence;
4. The agency of Water-currents and Ice;

5. The Wind;
6. Insects;
7. Birds;
8. Quadrupeds;
9. Snails;
10. Man.

**1. Locomotion.**—Many of the lower Cryptogams are free locomotive organisms, moving either by means of amœboid contractions and expansions of their mass, or by the aid of vibratile cilia. Some of these are locomotive throughout their entire existence; others possess the power of movement only during one period of their life-history. Of the amœboid movement we have an example in *Æthalium septicum*, the so-called "flowers of tan." This fungus is one of the Myxomycetes, and consists of a small naked mass of protoplasm, which is capable of creeping great distances over a moist surface by means of retractile processes quite similar to the pseudopodia of the amœba.

In *Protococcus*, again, we have a unicellular plant which during one part of its existence leads a locomotive life, and effects progression by means of a couple of fine hairs or cilia. Ciliary motion is also exemplified in *Volvox*, so well known to students of the microscope. The peculiar and as yet unexplained movements of some Diatoms must also have an important bearing on the distribution of these minute organisms.

**2. Vital Activity of the Germ.**—Of more importance in relation to our present subject are such ciliated zoospores as we find in *Vaucheria*, the common tangle (*Laminaria*), and the green laver (*Ulva*). In these algæ dispersion is effected by the free and spontaneous movement of motile swarm-spores aided by currents, so that any further provision for the distribution of the species would be superfluous.

The antherozoids of Ferns move by means of their cilia, and distribute themselves in all directions. In this way, by swarming over the entire surface of the

prothallus, it is insured that at least some of them will reach the germ-cells they are intended to fertilise. Such locomotive antherozoids are produced by Ferns, Horsetails, Lycopods, Liverworts, Charas, most Algæ, and many Fungi. The Florideæ, or Red Seaweeds, form an exception; the antherozoid, in this case motionless and destitute of cilia, is carried to the archegonium by water currents. Among flowering plants spontaneous movement on the part of the pollen-grain is of very doubtful occurrence, though Dr. Horn asserts that the pollen-grains of *Cereus* exhibit movements. Whether pollen-grains ever actually move or not, we have a near approach to this in the movements of the pollen masses of *Orchis*. It is noteworthy, also, that of the floral organs the stamens are endowed with the power of movement far more frequently than any other part of the flower, *e.g.*, *Helianthemum*, *Berberis*, *Parnassia*, etc. On the whole, however, distribution by the vital activity of the corpuscle itself is mainly characteristic of the male reproductive cells of the higher Cryptogams. The frequency of spontaneous movement in the male cell affords another illustration of its superior adaptation for dispersion as compared with the fertilised germ.

Under this head may also be mentioned the remarkable moving seed of *Myzodendron*, which, without exaggeration, may be said to perform a somersault on the branch of a tree. This plant resembles the mistletoe in its parasitic habit; the seed on alighting fastens itself to a branch of its host by means of long tendril-like processes. In several kindred parasites this fastening is effected by the viscid exterior of the seed. Soon after this the radicle emerges from the seed-coats, and curves towards the branch, against which it presses with its point. A flat disk is thus formed at the extremity of the radicle, and this, as well as the seed, adheres to the branch. If the spot happen to be unsuitable, the radicle, instead of penetrating, straightens itself

up, tearing the seed away from the branch. By curving over in another direction the radicle now transfers the seed to a different spot. When the seed has once more been securely fastened, the radicle lets go its hold, curves over again, and applies its adhesive disk to a fresh spot. Should this prove favourable, germination proceeds, and the plant becomes finally fixed; but if the place be not suitable, the somersault may be repeated several times over. Seeds of this description, which had fallen on the leaves of a tree, have been observed to remove to a branch in the manner described. The radicle of mistletoe, to which *Myzodendron* is allied, also develops in an exceptional manner, and differs from most ordinary roots in not being geotropic. Young roots, as a rule, direct their points towards the centre of the earth; but the radicle of *Viscum* is not affected by gravity, for if its seed be fastened to the under side of a branch, the young root, instead of pointing earthwards, directs itself towards the centre of the branch.

3. **Hygroscopic Action and Turgescence.**—Hygroscopic movements are brought about by the contraction of tissues in the course of drying. We have an example of this in the warping of unseasoned timber, where the bending is caused by the younger sap-wood on the one side contracting at a different rate from the older heart-wood on the other. Fibres especially are prone to bend and twist as they dry. Every angler knows how cat-gut unbends and straightens when put into water. Advantage is taken of this property in the simple old-fashioned weather-glass, still sometimes to be seen, consisting of a model house having two doors. Good weather is indicated by the appearance of a small female figure at one door, rain by the figure of a man coming out at the other. The figures are attached to a support suspended by a fibre of cat-gut, which twists or untwists according to the state of the atmosphere. The instrument is really a hygroscope or hygrometer,

indicating the humidity of the air, and the figures are made to swing round by hygroscopic action. This principle is utilised for the dispersion of plants in a variety of ways. The simplest case is perhaps the elaters attached to the spores of *Equisetum.* Each spore is provided with four thread-like processes, which curl and uncurl according to the varying dryness or moistness of the atmosphere. The result is that any change in the hygrometric condition of the air causes the spore to move rapidly across a level surface as if mounted on a liliputian bicycle. Elaters of a slightly different form occur among the spores of many species of Hepaticæ.

The hygroscopic property more commonly resides in the sporangium, or spore-case, than in the spore itself. The contraction of its walls while drying very often causes a sudden rupture of the wall at its weakest part, whereby the contents of the spore-case are forcibly ejected. Ferns have an annulus or ring of highly cuticularised cells surrounding the sporangium. This contracts strongly in drying, and greatly assists in the expulsion of the spores. Explosive anthers are common in wind-fertilised flowers, such as *Urtica, Parietaria, Plantago,* grasses, and others. This fact reveals the close analogy between an anther and a sporangium. We may even accept it as pretty certain that the wall of the anther is in all cases more or less hygroscopic, tending to open in dry weather and to close again in wet, so that the pollen may be protected against rain.

The hygroscopic teeth on the peristome of Mosses would appear to have a somewhat similar bearing on the discharge of the spores. The dehiscence of seed-capsules is brought about by the contraction of their outer walls, and this often takes place in such a way that the seeds are violently expelled. Thus each half of the pod of broom (*Sarothamnus*) and of the vetch (*Vicia*), at the moment of dehiscence, suddenly twists round, whereby the seeds are

violently thrown out in various directions. The fruit of the common dog-violet (*Viola canina*) is especially interesting. Each of its three valves, when the fruit opens, has a double row of seeds. The valves are boat-shaped; in drying they contract till the seeds are all so closely jammed in, and the tension becomes so great, that the slightest touch causes those contained in one of the valves to be shot up into the air. Perhaps the arrangement in the violet regulates the discharge of the seeds, and insures that they are not all scattered simultaneously. This, at least, appears to be the explanation of the peculiar porous dehiscence of the poppy capsule, which is also hygroscopic. The pepper-box arrangement is advantageous, in view of the immense number of small seeds contained in the poppy capsule, and insures their widespread and gradual distribution. Possibly a similar purpose may be served by the successive dehiscence of the anthers seen in such flowers as *Parnassia*, *Saxifraga*, and *Ruta*.

Dehiscent fruits, as a rule, exhibit the hygroscopic character to a greater or less extent. Indehiscent and schizocarpic fruits do not possess it to the same degree. Where a fruit only contains one seed there is no reason why it should open to discharge that seed. The dispersion of the fruit itself is sufficient. The dehiscence of fruits, then, is determined by the need for dispersing the contained seeds. It may be laid down as a general rule that single-seeded fruits are indehiscent, while fruits containing many seeds open to allow of their discharge and distribution. The dissemination of the fruit itself suffices where the number of contained seeds is small. In some plants two perfectly distinct modes of dispersion occur—one for the distribution of the fruits, and the other for the scattering of the individual seeds.

Instead of opening to allow of the escape of its seeds, a many-seeded fruit may break up into indehiscent pieces, each piece containing a single

seed as in the carcerulus of dead-nettle (*Lamium*). This class of schizocarps includes the cremocarp of Umbelliferæ and the regma of Geraniaceæ. In the latter the fruit has a long beak or carpophore, to which the one-seeded carpels adhere. When ripe the carpels separate by their bases from the carpophore and spring apart. At the same moment they dehisce along their inner edges, and by the suddenness of the movement the seeds are shot out to a distance of several feet. Some species have the carpels, or rather mericarps, indehiscent, in which case the carpel itself and not the seed is the body projected. This happens in the stork's-bill (*Erodium*), belonging to this order. The fruit of *Erodium* is perhaps the most interesting of all the hygroscopic class. When it springs away from the carpophore in the manner just described, the carpel of *Erodium* is seen to have a long slender filament at its apex which is in the act of curling upon itself. After the carpel alights, its awn continues to curve and twist for a minute or two, until at last it has acquired the cork-screw form and comes to rest. As long as the awn is kept dry it does not change, but if it be moistened with a drop of water it immediately begins to straighten out, and in the course of a minute or two becomes quite straight. At the same time two or three fine bristles near the base of the awn spread out and lift up the carpel so that its sharp point is directed into the soil. If now, as was in all probability the case, the upper extremity of the awn had been pressing against some object which afforded a point of resistance, the moistening, in consequence of the untwisting and elongation of the awn, would have caused the point of the carpel to be forced downward into the earth. Should the soil after a time get dry, the awn will once more curl and assume its cork-screw condition; but instead of the seed being drawn up by this shortening of the awn, the latter is drawn down, for the seed holds on, its point being barbed like a harpoon.

The chances are now that the upper extremity of the awn has been applied to a new point of resistance, so that the next rain will send the seed still deeper into the soil, and so with every succeeding change of weather. *Erodium glaucophyllum* has the upper part of its awn feathered, the more certainly to secure that it will press against some resisting object when it begins to unwind itself. In the common *E. cicutarium* the awn is not feathered. In this genus the seeds may literally be said to screw themselves into the earth; and the same applies to *Anemone montana*, which has an awned achene capable of burying itself in this manner. The feather-grass (*Stipa pennata*) has the same peculiarity, and perhaps also some species of *Clematis*. *Avena sterilis* has a hygroscopic awn, by means of which the seed can shift from place to place. Possibly it may also be of use in enabling the seed to penetrate the soil. Aristate grains and seeds fall, however, to be considered in another connection. Here we may recall the fact that many plants bury their seed-pods in the soil, *e.g.: Linaria Cymbalaria, Trifolium subterraneum, Arachis hypogea, Cardamine chenopodifolia*, etc. This, however, is more likely to be due to an aversion towards light (aheliotropism), or to the action of gravity (geotropism), than to hygroscopic action.

To the class of schizocarps also belongs the remarkable fruit of *Hura crepitans*, called the "monkey's dinner-bell" because its woody carpels when quite dry separate suddenly with a noise like the report of a musket. The stellate capsule of the ice-plant (*Mesembryanthemum*) is very hygrometric, and opens when moistened.

*Oxalis* has a seed with an elastic testa, by the sudden rupture of which the central core of the seed is projected out to a considerable distance. The hairy-cress (*Cardamine hirsuta*) is a well-known example of an elastic fruit. If the ripe siliqua be touched, its two valves quickly curl up and the seeds

are shot out in all directions. The fruit of Balsam (*Impatiens*) is somewhat similar. *Catasetum*, a remarkable genus of Orchids, has flowers which throw out their pollen-masses at any insect which happens to touch their "antennæ." Along these sensitive appendages of the flower the impulse is conveyed to a delicate membrane which retains the pollinia in a state of tension. By the sudden rupture of this membrane the pollinia are thrown out in the direction from which the stimulus comes. A sharp line can hardly be drawn between hygroscopic movements and those due to turgescence. Of the latter, the pepo of *Momordica elaterium* furnishes an illustration. This plant is called the squirting-cucumber, because, when the fruit breaks away from its stalk, the seeds, along with the watery contents, are shot out as from a syringe. This result, in so far as it is due to the contraction of the walls of the fruit, is hygroscopic, but very probably fluid pressure brought about by endosmotic activity has also something to do with it. And the same might be said of those fungi which adopt a similar mode of dispersion. The mortar-fungus (*Sphærobolus stellatus*) projects its sporangium very much in the same way that a shell is thrown from a mortar. Here the globular sporangium, retained by the outer membrane of the peridium, is pressed from behind, till the tension suddenly ruptures the membrane and the sporangium is forcibly expelled. The sporangium of *Pilobolus*, another genus not at all closely related to *Sphærobolus*, is thrown off by the turgescence of an underlying cell. Among the Ascomycetes, many *Pezizæ* and *Sphæriæ* have their spores forcibly expelled from an aperture at the top of the ascus. In *Ascobolus* the asci themselves, as its name indicates, constitute the projectiles. By means of such artillery many of these fungi bespatter neighbouring plants with their sticky fruits and spores. One of the Gasteromycetes presents a curious analogy to *Magnolia*. The sporangia of *Nidularia* hang over

the edge of the cup-like peridium, attached by their elastic stalks, very much as the seed hangs outside the capsule of *Roxburgia* and *Magnolia*. In a few cases the entire plant-body appears to be hygroscopic, and advantage may be taken of this property to aid in dissemination. Thus the Rose of Jericho (*Anastatica*), a small annual found in sandy places in Syria, has the curious habit of curling up its leaves into a ball; the rootlets become detached from the dry earth, and the plant is rolled along the ground by the wind. On reaching a moist spot, the plant unfolds, its pods dehisce, and the seeds are sown. From this remarkable habit *Anastatica* has received its name of "the resurrection-plant." It belongs to the order Cruciferæ; but an Australian grass (*Simplifex squarrosus*) and a Brazilian Club Moss (*Lycopodium squamatum*) have also been described as possessing the same curious wandering habit. The stems of the Swan's-neck Moss are so hygroscopic that on separation they can disperse themselves very much like the grains of *Avena sterilis*.

From the examples now given it will be seen how widespread is the employment of hygroscopic agency throughout the vegetable kingdom, wherever the distribution of reproductive cells is in question. Of the forces employed by man, perhaps hydraulic power comes nearest it; and it may not be overstepping the proprieties of language to refer to the contrivances just described as examples of "vegetable hydraulics." Instances in which advantage is taken of this property of vegetable tissues can, as we have seen, be adduced from all classes of plants. Thus it is called into play to promote the distribution of spores in Ferns, Horsetails, Mosses, and Fungi; for scattering the pollen in *Urtica*, *Parietaria*, and *Catasetum*; for sheltering the pollen in most anthers; and for the dispersion of seeds in *Cardamine*, *Impatiens*, *Sarothamnus*, *Vicia*, *Viola*, *Oxalis*, *Geranium*, *Mesembryanthemum*, etc. With the exception

of the wind, no agency is more in requisition for the dissemination of plant-germs. But notwithstanding this, hygroscopic agency seems to play only a subordinate rôle in the distribution of plants. We have but to consider how limited is the range of this force, to see that it must be so, and that the hygroscopic property is chiefly of value in relation to other and more efficacious agencies.

**4. Water Transport.**—A seed, the weight of which in air would at once cause it to fall to the earth, may, on account of the greater density of water, remain suspended in that liquid sufficiently long for the gentlest current to carry it a considerable distance. Hence it comes that special provisions for transport by water are seldom required, and have been observed only in a very limited number of plants.

The non-ciliated antherozoids of the Florideæ, or red seaweeds, as we have seen, are transported by this means. According to Dodel-Port, the fertilising currents in this case are often due to an animal. It seems that on the fronds of these algæ the ciliated infusorian *Vorticella* grows abundantly. This elegant little organism, with its exquisitely formed bell and delicate spiral stem, might be described as a miniature lily, but for the transparency of its tissues and the activity and energy of its movements. The animal at will can lengthen or shorten its stalk; and by alternately extending and retracting it, *Vorticella* imparts to its bell a graceful rhythmic motion. This movement, aided by the action of the cilia with which the bell is fringed, gives rise to tiny whirlpools in the surrounding water. By the vortices so caused, currents are generated which assist in the fertilisation and dissemination of the Florideæ. For the reception of the antherozoids there is here also associated with the archegonium a special filament—the trichogyne — to which these corpuscular antherozoids adhere. Except in those cases where the spore

itself possesses the power of movement, marine plants must, as a rule, depend for the distribution of their reproductive cells upon water-currents, as we see in the tetraspores of Florideæ, and in the fertilised oöspheres of *Fucus* and other olive seaweeds.

Water-fertilised flowers, like *Zostera*, *Ceratophyllum*, *Ruppia*, etc., in their arrangements for crossing, very much resemble the wind-fertilised class. The same unspecialised character belongs to the flowers of *Callitriche*, *Hippuris*, and *Myriophyllum*, which may be either anemophilous or hydrophilous. *Vallisneria* is especially interesting, for although for the most part immersed, its fertilisation takes place in the air. The plant is submerged all but the female flowers, which are attached to long spiral stalks. The small male flowers grow near the bottom, but become detached, rise, and swim on the surface of the water. They may now be blown in the direction of the pistillate flowers; but whether the pollen is floated to the stigmas, carried by wind, or transferred by insects, is not very clearly made out. Herman Müller considers this a transition from the water-fertilised to the insect-fertilised class of flowers.

Fruits and seeds specialised for this mode of distribution show adaptation—first, in having their specific gravity reduced by the presence of air cavities in their tissues; and secondly, in their being impermeable to water to prevent injury in course of transit. The fruit of the water lily (*Nymphæa alba*) is matured under water; when ripe it breaks away from the peduncle, and, according to Hildebrand, its walls separate, setting free a globular mucilaginous mass in which the seeds are imbedded. This spongy, gelatinous mass encloses a number of air-bells, and floats for a time. Ultimately, however, it disintegrates, the air bubbles escape, and the seeds separate. Each seed now continues its voyage alone, kept afloat by the

inflated arillus with which it is surrounded. By-and-by this too gets waterlogged, and the seed sinks to the bottom. The seed of *Nuphar luteum* is not provided with an inflated arillus as in *Nymphæa.* After separating from its stalk, the fruit loses its outer wall, and the disjoined carpels float off in different directions. Air-bells enclosed by mucilage keep the carpel afloat for a longer or shorter period. When at last its outer covering decays, the air-bubbles gradually escape, the gelatinous mass slowly dissolves, and, as it drifts, drops its numerous seeds one by one to the bottom. It would be difficult to conceive of a more perfect contrivance for dispersion through the agency of water than this flotilla of rafts by means of which the water lilies strew their seeds far and wide over the bottom of the waters where they grow. The curious fruit of *Nelumbium*, which consists of an enlarged receptacle in which the nuts are inserted as in sockets, may also be intended to serve as a raft which shall, by discharging its freight in this piecemeal fashion, secure the wide distribution of the seeds. The fruit of the Indian-cress (*Tropæolum*) is very light in proportion to its size, and that of *Valerianella* has two empty cells, but these are possibly capable of dispersion by wind. The seeds of *Lemna* sink and remain below the water during winter, but rise to the surface in spring.

Minute bodies, especially those which do not readily become wetted on account of their surfaces having little affinity for water, even if they are heavier than that liquid, do not sink, because the cohesion of the water is not destroyed. This property certainly belongs to several seeds, and possibly to the pollen-grains of *Vallisneria.* The fringed seeds of *Spergularia*, for this reason, can lie on the surface of the sea for a considerable time without becoming wet. Very few seeds, however, appear to be able to resist the action of salt water for any length of time. Still, that some seeds do

resist its influence is proved by the fact that on the coasts of Norway various Mexican seeds and fruits are washed ashore from the Gulf Stream, still retaining their germinating power. "Crabs'-eyes," or the black-and-red paternoster-seeds of *Abrus precatorius*, are washed up on the shores of many tropical countries, and the tree is common along their coasts. It is difficult to resist the conviction that this is also the end served by the thick woody envelope of the cocoa-nut, for in this way its wide range could be easily accounted for. Such a thick woody pericarp would be of the greatest service in the case of a seed transported by ocean currents and washed ashore through a heavy surf upon a newly emerged coral-reef. The need for such protection is of course great where, as is the case in the cocoa-nut, the seed is so large and its contents so perishable in their nature. One is inclined to view the shell of the hazel-nut in the same light. When one remembers that hazels commonly grow on the banks of streams, it seems not improbable that the hard shell or pericarp is an adaptation favouring its distribution by means of floods. This explanation, however, it must be admitted, does not apply very well to the shell of the acorn. Many alpine plants have their seeds carried down, as we know, by mountain streams, and cast up on their banks at lower levels. Everyone must have noticed in climbing any of our higher mountains how alpine species of *Saxifraga, Galium, Alchemilla*, etc., are thus brought down far below their natural levels.

The flat smooth fruit of the arrow-head (*Sagittaria sagittifolia*) has an oily rind not easily wetted. This fruit appears adapted for transport either by wind or by water. And this may possibly be an advantage to a plant which, like *Sagittaria*, grows in shallow waters which, at the time when its fruit is ripe, are very likely to dry up more or less completely.

Icebergs drifting from polar seas are often freighted with quantities of stones and earth. Seeds and

spores embedded in ice, as Lyell has shown, must sometimes be floated far away from their place of origin. The presence of arctic species in certain localities can thus be accounted for. As the Glacial Period drew to a close, many northern plants must have been distributed in this manner. The carriage of seeds by ice can, however, be only an occasional occurrence, and, though important in relation to the geographical distribution of plants, possesses only a secondary interest from the point of view of botanical biology.

5. **Wind Transport.**—No natural agency is more taken advantage of by plants for the dispersion of their germs than the wind. A large percentage of the floating matter of the air is of organic origin. This fine organic dust must consist partly of vegetable cells capable of development if they should happen to alight in a favourable soil. In the case of minute unicellular plants, such as *Bacteria* and *Micrococcus*, the entire organism may remain suspended in the air for a length of time and be carried hither and thither by air currents. Strong winds which uproot large plants may also occasionally transport them short distances. But it is only with the reproductive bodies thus blown about that we have now to do.

As a dispersive agent for securing widespread and general distribution, the wind possesses great efficiency. Wind - dispersion, however, generally involves a large amount of waste. Especially is this true in the case of pollen-grains, where the transported bodies require not only to be distributed, but to be delivered at particular spots. For this reason more economical modes of conveyance are frequently adopted. And even in those plants which employ the wind, we often find special arrangements for restricting the waste and securing the proper delivery of their germs.

(*a*) *Spores.*—Among the Cryptogams, wind-dispersion is very general. The spores of Ferns, Lycopods, Mosses,

and most Fungi, including Lichens, depend mainly on the wind for their dissemination, but show no special adaptation further than minuteness, lightness, incoherence, and prodigious numbers. A further provision is seen in Coniferæ. Each pollen-grain of *Pinus* is furnished with two wings formed by the inflated extine—structures which must very materially aid in dispersion. In one respect, however, the Cryptogams seem to have an advantage over the pine and other Gymnosperms. The open carpels of the Coniferæ and their allies are destitute of stigmas. The pollen-grain must be conveyed to the ovule, and the only provision for its reception is a drop of fluid exuded from the micropyle. In the absence of a specialised stigma, the only guarantee that any of the pollen-grains will reach their proper destination is that afforded by their enormous numbers. The probability of any coniferous ovule being properly pollinated would be slight but for the fact that the pollen is showered down everywhere, and it is next to impossible for all the ovules on a cone to escape. But it is improbable that every ovule will be fertilised, and many which the pollen never reaches must perish. From the more perfect arrangements for the delivery of the fertilising cells, the oöspheres of Cryptogams seem to stand a better chance of fertilisation than the ovules of Coniferæ. The pollen of the latter is passive and motionless, whereas the antherozoids of the Cryptogam are not only active and motile, but have the additional advantage of being dispersed from secondary centres, as will be explained presently. Wind-fertilised flowers have usually an expanded feathery or penicillate stigma, exposing a relatively large stigmatic surface, and increasing the flower's chances of fertilisation. At the time of flowering, these expanded stigmas intended for the reception of the pollen are fully exposed. Its safe arrival is therefore an event of much greater probability than the pollination of a coniferous ovule.

The existence of a truly wind-fertilised Cryptogam has not yet been demonstrated—that is to say, we do not know of any instance in which the wind conveys a motionless antherozoid to the archegonium, as is done by water currents in the case of the Florideæ. Dogmatically to assert that no plant exists in which the antherozoids are carried by the wind would of course be hazardous in the present state of our knowledge. Very possibly some of those reproductive structures of unknown function, such as the spermogones of the Uredineæ, may yet be found to be adaptations in this direction. If a wind-fertilised Cryptogam should ever be discovered, we might expect the archegonium to show a special provision for the reception of the antherozoids. Meantime the only structure we know among flowerless plants which in function approaches the feathery stigma of a grass is the trichogyne of the Florideæ, to which we have before referred. Although we are not acquainted with any flowerless plant which, strictly speaking, is wind-fertilised, still from another point of view we may regard the higher terrestrial Cryptogams as being wind-fertilised. In Ferns, where only one kind of spore is produced, there is but one sowing, or at least only one in which the wind is concerned. The spore, on germination, gives rise to a flat leaf-like prothallus, which bears on its under surface male and female cells—antheridia and archegonia. Each antheridium becomes a new centre of dispersion discharging motile ciliated antherozoids. These swarm over the entire surface of the prothallus, so that some of them almost inevitably enter the opening of the archegonium and fertilise the oösphere. Where the same prothallus bears both antheridia and archegonia, and where there is no necessity for cross-fertilisation, the swarming of the antherozoids may be sufficient to effect their proper delivery, and in that case we can hardly regard the wind as playing any part in the process

of fertilisation, though disseminating the spores. The case is entirely different, however, when, as is frequently the case even in Ferns, the prothalli are diœcious; and still more so in plants which, like *Isoëtes* and *Selaginella*, produce two kinds of spores. The locomotive power of the antherozoid, being of short duration, would hardly be sufficient to carry it from one prothallus to another if there was any considerable distance to be traversed. There must, therefore, be what is equivalent to a separate sowing for each kind of spore. And, even if cross-fertilisation be as important among Cryptogams as it is among flowering-plants, the only means of accomplishing it is the mingling of spores brought about by the wind. This mixing of male and female spores practically amounts to wind-fertilisation. Where a plant produces two kinds of spores, the macrospores are fewer in number than the microspores, and, consequently, will be more thinly sown. If the number of macrospores be very small, the probability in any particular instance that a microspore will alight upon one of them is slight. Were there, then, no further provision than exists in Coniferæ, fertilisation, and especially cross-fertilisation, would rarely, if ever, occur. But after the development of the male prothallus every microspore becomes a new centre of dispersion from which antherozoids are distributed in every direction, so that the chances of fertilisation, and even of crossing, are greatly increased. We therefore see that in the heterosporous Cryptogams, and in those producing male and female prothalli, the process of fertilisation may be regarded as consisting of two parts. The first part of the process, viz., the distribution of the micro- (or male) spores, is effected by the wind; the second, or delivery of the antherozoids to the archegonium, is the work of these locomotive bodies themselves. The swarming movement of the antherozoids more than compensates for the absence of an expanded

stigmatic surface in connection with the archegonium, and secures their safe delivery. Except for this difference, we might regard the higher Cryptogams as wind-fertilised. The Gymnosperms probably represent transition-forms which have lost their antherozoids and have not yet acquired the specialised stigma of wind-fertilised flowers. The distribution of antherozoids from the microspores as secondary centres, which makes the fertilisation of these Cryptogams, other things being equal, a matter of much greater probability than the fertilisation of a Gymnosperm like the pine, where no special provision is made for the delivery of the pollen-grain, reveals the importance of secondary centres in dispersion. When the object to be gained is the delivery of a germ at a particular spot, this may be attained either (first) by the distribution of a vast number of such germs from one centre, or (second) by the dispersion of a smaller number from the primary centre, and by each of the germs so dispersed itself becoming a new centre of dispersion. The latter has the advantage of securing a more equable distribution. This principle perhaps explains a peculiarity in certain parasitic fungi. The æcidiospores, uredospores, telutospores, and sporidia, to which *Puccinia* successively gives rise, represent so many centres of dispersion. This extreme dispersive efficiency would appear to be necessary in order that the fungus may succeed in transferring itself from the Berberry to the Wheat and again from the Wheat to the Berberry. Where the method of secondary centres is in operation it will be of advantage if, as in the higher Cryptogams, bur-dock (*Arctium*), and spindle-tree (*Euonymus*), an agency is employed for effecting dispersion from the secondary centres different from that which occasions the first sowing. The various points now discussed will perhaps be better understood from an illustration. The postal system of a large city affords an instructive parallel. If the general post-

office be taken to represent the primary centre of dispersion, the branch offices will correspond to the secondary. The delivery of any extra large mass of correspondence, such as that with which the postal authorities have to contend at Christmas, presents nearly the same problems as the distribution of plant-germs. The delivery of the letters may be effected directly from the head office; but a smaller number of men would suffice were all the letters for each district in the city despatched to the various branch offices, and the letter-carriers then to proceed with the delivery from these new centres. The delivery, too, would be greatly facilitated if every house in the city were provided with a letter-box. Applying now our illustration, we may compare the Conifers to a city in which all the work is accomplished from the central office, there being no branch offices and a complete absence of letter-boxes. In wind-fertilised Phanerogams, the delivery is made from the general post-office, while the fringed and feathery stigmas play the part of letter-boxes. The higher Cryptogams, again, correspond to a city in which the delivery is effected from secondary centres, and in which a mode of conveyance is employed to carry the letter-bags from the general to the branch offices different from that used to take the letters from the branch offices to the houses. The microspores correspond exactly to the mail-bags distributed to the branch offices, and the antherozoids to the letters they contain. To complete the analogy, we should have to imagine a city in which the mail-bags were carried from the general to the branch offices by balloon, and that from the district offices the letters themselves marched out in all directions to their respective destinations, where, in the absence of letter-boxes, they pushed themselves under the doors.

(*b*) *Seeds.*—The seeds of Phanerogams are of larger size and fewer number, and require more obvious adaptations, than pollen grains or spores. Neverthe-

less in a good many orders the seeds appear to depend for dispersion on their minuteness and abundance, and show no further specialisation. Small seeds of this description occur in *Scrophulariaceæ, Crassulaceæ, Cistaceæ, Campanulaceæ, Lythraceæ, Orobanchaceæ, Begoniaceæ,* and in many *Caryophyllaceæ, Gentianaceæ, Saxifragaceæ, Papaveraceæ,* etc. Fruits or mericarps, adapted by their small size to wind-dispersion, are exemplified in *Urtica*; in some of the *Malvaceæ* and *Labiatæ*; in such *Umbelliferæ* as *Apium, Bupleurum, Ammi, Pimpinella,* etc.; and in a few composites, such as *Artemisia, Bellis, Matricaria,* etc.

The longer the time during which the wind is allowed to act upon a falling seed, and the larger the surface upon which it acts, the farther will the seed be carried. On this account, a reduction of specific gravity is of greater importance than even a reduced size. On this principle may be explained the seed of *Orchis*, where the solid body of the seed is loosely enveloped in the enlarged and membranous integument. Such, no doubt, is also the advantage conferred by the lax testa on the seeds of *Pyrola, Monotropa, Parnassia, Drosera, Nepenthes,* etc.

Compressed, flattened, and peltate seeds have their shapes adjusted to meet these requirements. This adaptation of shape is illustrated in the seeds of *Glaux, Trientalis, Anagallis, Iris, Gladiolus, Fritillaria, Tulipa, Strychnos Nux-vomica,* etc.

A further advance in this direction is shown by flattened seeds provided with a membranous border. As examples of these margined seeds, which are very common, may be mentioned *Rhinanthus, Lysimachia, Linaria, Spergula, Spergularia, Alyssum, Lilium, Scilla, Syringa,* etc.

An improvement upon the membranous border is made in the winged seeds of *Casuarina, Bignonia, Moringa, Swietenia Mahogani,* etc. In the winged seeds of *Pinus*, however, the wing is not derived from the seed itself, but is a lamella from the cone-

scale adherent to the seed. A scale of the inner pericarp adheres in the same way to the seed of the Dutchman's-pipe (*Aristolochia Sipho*). This curious seed has, besides, a wing of its own and a spongy body attached to it, but the meaning of this complicated apparatus requires further investigation. Winged fruits are of more frequent occurrence than winged seeds. Sometimes the wing is vertical, as in *Peltaria*, *Isatis tinctoria*, *Anemone narcissiflora*, and *Oxyria;* or it may be horizontal, as in *Paliurus australis.* Familiar examples of winged fruits or mericarps are afforded by *Acer*, *Ulmus*, *Betula*, *Fraxinus*, *Thlaspi*, *Lepidium*, *Iberis*, *Heracleum*, *Peucedanum*, etc. Three wings occur on the fruit of *Thalictrum aquilegifolium*, *Tripteris*, and on several species of *Polygonum* and *Begonia.* The appendages are still more numerous in some fruits, particularly in those of the *Malpighiaceæ*, while *Eryngium* has its fruit covered with wing-scales. Occasionally—as in *Armeria*, *Valerianella discoidea*, *Salvia aurea*, *Polygala virgata*, and *Trifolium fragiferum*—the persistent calyx, more or less inflated, is made to do the duty of wings. *Rumex* may be included here, its wings being derived from the perianth. In one or two cases the pericarp or calyx acquires a spongy texture, as in *Margyricarpus setosus.* The bracts in *Carpinus*, *Tilia*, *Humulus*, *Briza*, *Holcus*, *Phalaris*, etc., discharge the function of wings, while a five-winged parachute is formed by the persistent corolla of *Melanorrhœa usitata.*

In all the cases now cited, these wing-like appendages have a thin, membranous, or even papery character, and are attached to bodies which, since they separate from the mother-plant, must be intended for transmission by the wind. *Begonia*, however, has a winged, many-seeded capsule, which does not detach itself from the stalk. Wings in such circumstances cannot subserve flight, but present a large resisting surface to the wind, so that the capsule has its seeds shaken out, with the further

advantage that this only occurs on days when the wind is sufficiently strong to bear them some distance away. To promote in this way the waving to and fro of the dehiscent fruit, with the object of scattering the seeds, is doubtless also the use of the inflated persistent calyx of *Rhinanthus* and *Silene inflata.* The large capsules of *Papaver*, *Iris*, *Tulipa*, *Scilla*, and several *Campanulæ* are admirably adapted to have their seeds shaken out by the wind in this fashion. Another point of interest is well illustrated in the genus *Campanula.* Some species have upright capsules; these dehisce at the top. Others with an inverted capsule discharge their seeds through openings at the base of the capsule near the flower-stalk. The arrangement in both cases prevents the seeds being emptied out together; otherwise they might fall straight to the earth and form a heap at the base of the plant.

The blade of the wing, in most cases, is either slightly twisted or set at such an angle that the fruit or seed in descending does not fall perpendicularly, but either flutters slowly down, shoots aside, rotates, or eddies round in circles. By this simple arrangement the velocity of its descent is diminished; the seed will be longer exposed to the wind's action, and carried in consequence to a greater distance. A seed or fruit with vertical evenly-set wings, if it should happen to fall with these appendages presenting their edges to the direction of the wind, would reap no advantage from their presence. But if the wings be set obliquely this cannot happen, for even in still air the seed in descending begins to rotate on its axis, and thereby brings its wings broadside on to the wind. If the seed revolves round its horizontal axis, it will appear to flutter, and will have the full benefit of any ascending current. This explains why these whirling and gyrating seeds are so easily spirited away on the breeze. This oblique turn is well seen in the winged fruit of the ash (*Fraxinus*).

The three wings of the beech (*Fagus*) are slightly twisted—the fruit itself might indeed be compared to a rifle-bullet with its spiral grooves and ridges; and a well-developed samara of the sycamore (*Acer Pseudoplatanus*) resembles uncommonly the screw-propeller of a model steamship.

The hairs or plumes with which so many seeds are furnished constitute an appliance better adapted for dispersion than even the wing-like expansions just considered. Hairs, if horizontal, prevent a seed from falling quickly, and keep it afloat in the air; if vertical, they act like sails, exposing a large surface, so that the seed is impelled rapidly before the wind. Sometimes the entire outer surface of the seed is beset with long silky hairs, as in the cotton-plant (*Gossypium*) belonging to the Malvaceæ. In the allied Sterculiaceæ, or silk-cotton order, several genera, including *Bombax*, *Eriodendron*, etc., possess the same peculiarity. More frequently, however, the hairs are confined to one end of the seed, and form a tuft, as in *Salix* and *Populus*, where they grow from the funiculus and constitute an arillus. *Asclepia*, *Apocynum*, *Tamarix*, and *Epilobium* have an arillode, the hairs springing from the micropyle of the seed. *Hibiscus* and *Alstonia* have seeds tufted at both ends. In *Anemone Pulsatilla*, and several species of *Clematis*, *Dryas*, and *Geum*, as well as in the plume-nutmeg (*Atherosperma*), hairs are developed from the pericarp. The pappus of Compositæ and Valerianaceæ may be considered calycine. Hairs are developed from the flower-stalk in *Eriophorum* and *Typha*, while several grasses have them on the bracts.

The pappus of Compositæ exhibits considerable variety. In the thistle (*Carduus lanceolatus*), and in *Hypochœris*, it is feathery or plumose; in *Crepis* and *Sonchus*, pilose. The pappus of *Tragopogon* and *Taraxacum* is provided with a beak or stalk; that of *Hieracium* is sessile. These and other minor differences are not without significance. The special

form assumed by the pappus has probably in most cases some relation to the habits of the species. A plumose pappus is perhaps better adapted for transport, but the pilose form offers less resistance when the seed has to penetrate a mass of vegetation before reaching the soil. On the whole, the appendages of seeds will tend to assume the form best fitted to secure their delivery in situations such as are usually preferred by the species. The differences observed in the pappus of Compositæ correspond in all likelihood with differences in their habitats. The adaptation to wind-dispersion is in many plants of this order carried to great perfection. In some instances it almost seems as if the development of the pappus were of equal importance with the arrangements for the fertilisation of the flowers, so elaborate are the precautions to prevent injury and to insure that the plumes of the seed shall attain their proper condition at the period of ripening. During the early stages of maturation the bracts of the involucre are vertical, and securely enclose the capitulum, which almost re-assumes the appearance it had in the bud before the flowers expanded. *Tussilago* even inverts its capitulum until the fruit is ripe, when the flower-head again becomes erect so that the pappus may more readily catch the wind. No one who has closely observed the thistle-down can readily forget it, so beautiful are its silky plumes and so admirably fitted to fulfil their purpose. If a flower-head in course of ripening be opened, each separate fruit is seen to be tipped with a pencil of long silky hairs. Somewhat later these begin to separate and spread in all directions. Just then the connection below with the receptacle is loosened, and the spreading of the hairs has the effect of raising the seed out of the cup-like capitulum. A certain number of the hairs are even directed downwards, their points resting on the floor of the receptacle. At first these vertical hairs are not straight, but wavy; and, as they straighten, the

fruit is elevated as a person's body is raised when he stands on tiptoe. By the spreading of the pappus the fruits literally lift themselves out of the involucre as if on stilts, and from the ripe capitulum the thistle-downs appear to issue like foam. From the capsules of the willow, poplar, and cotton-plant, the seeds also lift themselves out by the spreading of their hairs. To see the thistle-seed thus raised and poised on the edge of the capitulum, shaking out its silken fringes in the dry autumnal air, reminds one of a bird pluming its feathers preparatory to flight. When at last its snowy pinions are fully expanded, and it soars away on the breeze, we need only follow it a little to see that the adaptation does not end here. Should the fruit collide with a branch or other object the shock is generally sufficient to detach the solid seed from its pappus. The plumes, having served their purpose, are discarded, and the seed, freed from encumbrance, falls to the soil. The readiness with which the smooth solid portion of the fruit becomes detached is an important provision enabling it readily to penetrate matted vegetation and reach the soil. This, no doubt, arises from the continued desiccation of the pappus.

A very curious special provision, favouring the departure of the seeds, occurs in the willow-herb (*Epilobium*). The narrow elongated capsule splits into four linear valves which separate from the central axis, but the seeds, instead of falling out, remain suspended in four vertical rows between the valves. This cresset-like arrangement might be said to resemble roughly four vertical ladders set in a square. On the middle of each rung of the ladders a seed is perched, the rungs themselves being formed by the hairs of the arillode with which each seed is furnished. The tuft of hairs on every seed is parted in the middle, one half being attached to one valve and the other half to the next. The way the seeds are superimposed on one another gives to each of the four vertical series a herring-bone appearance.

Each of the four valves, the dehiscence being loculicidal, consists of two half-carpels, and the ends of the hairs are caught and pressed by the edges of the carpels. Now, the effect of this curious arrangement is that as the valves in drying curl and become more and more divergent, the carpels at the same time slackening their hold of the hairs, the seeds are liberated one by one and scattered on the wind. No doubt the special provision has in this case been rendered necessary on account of the shape of the capsule being ill-adapted to afford the seeds a fair start. Another arrangement facilitating the despatch of the seeds is seen in the feathery globe of fruit formed by the dandelion (*Taraxacum*) so familiar to everyone. *Tragopogon* has a downy sphere of the same description, but four or five times bigger. Here, as in the thistle, the capitulum is closely invested by the involucre while the fruit is maturing. If a flower-head in this stage be examined, each fruit is seen to terminate above in a slender beak which bears at its apex a pencil of silky hairs. When the fruit is ready, the bracts spread and become recurved, the floor of the receptacle becomes convex, and the brushes expand into parachutes. Having now only a very slight attachment to the flower-stalk, a moderate breeze suffices to dislodge and scatter ripe fruits. By means of its hairy parachute, dandelion-seed easily floats along on a current of air. It cannot be said, however, that in *Taraxacum* or *Tragopogon* the provisions for transport are equal to those of the thistle. These fruits are somewhat heavier, and in very still air will fall straight but slowly to the earth. They are not therefore adapted to be carried so fast or so far as thistle seed; but this disadvantage may be more than counterbalanced by their penetrating power, which we shall now endeavour briefly to explain.

The parachute of hairs is no doubt a very perfect contrivance so far as mere transport is concerned; but, besides this, the solid portion of the fruit in its upper

part is provided with several rows of projecting points, and a hispid surface is not uncommon on seeds adapted for wind-transport. On account of its lightness and the ease with which it is wafted, the fruit of dandelion would have difficulty in coming to rest if there were no provision by which it could anchor itself to fixed objects. Just as an aeronaut nearing the earth must throw out his grapple to prevent his balloon being blown about or carried out to sea, so the dandelion-seed requires these projections on its lower part to assist it in alighting on the earth. They are unnecessary in the case of the thistle on account of the readiness with which the pappus becomes detached. Further, the penetrating power of the dandelion-fruit is much greater than we should expect. To be convinced of this one has only to observe what happens when it alights on a tangled mass of dry grass. The seed, kept in its perpendicular position by its parachute, if the air be still, sinks into any opening among the grass-stems, and hangs swinging by its hairs for a time. When the next breeze shakes the mass of hay, the seed slips, but is caught by a grass-stem lower down, where it hangs suspended until another gust shakes the grass, when it slips off and falls down till the pappus-hairs are caught once more. This process is continued, every gust sending the seed farther and farther down into the mass, until at last the soil is reached. Having watched the passage of a dandelion-seed through a mass of hay in the manner described, the writer can only compare it to a bird hopping among the thick branches of a tree, perching now here and now there, but never striking against any of the boughs or twigs. In its descent the dandelion-seed is greatly assisted by the long stalk which supports the pappus, and by the small projections or barbs on the seed itself. These barbs serve to anchor the seed and prevent its being lifted up when it has once begun to penetrate; they enable it to keep every inch it gains.

From the examples just given it will be seen that wind-carried seeds present two well-marked types, viz., the winged and those furnished with hairs. The former are most characteristic of lofty trees; the latter are common on herbs and shrubs. Broad wings are unobjectionable in seeds blown from a height, but hairs are decidedly better when the seed is launched from a low level. Wings are open to the objection that when the seed is carried along by the wind a short distance above the ground, the expanded surface they present is almost certain to encounter some obstacle, with the result that the flight of the seed is arrested, and it falls to the earth. For this reason winged seeds are not well-adapted for low-growing plants. Another objection to wings is that they prevent the seed from readily reaching the soil if it happens to be covered with withered grass or other vegetation. Hairs have the advantage that they give the required buoyancy and do not offer so much resistance to the passage of the seed through among other plants.

The power of penetration belongs in a still higher degree to a third class of seeds. These are not specially adapted for wind-dispersion, being commonly without either wings or hairs, but instead are furnished with a long slender awn. The beard of Barley, and other aristate grains, is made up of such appendages. Occasionally the awn is hygroscopic; but in most cases it is rigid, brittle, and scabrid on its edges. Its minute barbs are directed towards the apex, so that when the finger is drawn along the edge of the awn from the apex towards the base it is felt to be rough. If a grain of barley be placed in one's sleeve, the movements of the arm will cause the seed gradually to work its way upwards towards the shoulder. Or again, if the seed be gently shaken in a blanket it will move along in one direction only, as the scabrid bristle prevents any backward movement. In the dispersion of grass-seeds transport to a distance would seem to be of

less importance than the power to penetrate to the soil. The prevalent spindle-shape of grass-seeds is well fitted for penetrating a resisting medium. Many of them are boat-shaped, while the seeds of *Bromus sterilis* and *Hordeum murinum* have the exquisitely symmetrical form of a gondola. A torpedo-shape is not uncommon, and the elongated almost needle-like seeds of the bog asphodel (*Narthecium*) have the advantage of being able to pass readily between the erect leaves of the plant itself, the stems of rushes, etc. In some cases the point of the seed is barbed and the awn feathered, so that the resemblance to an arrow is very marked. *Bromus sterilis* seems to throw its grains from the spike by hygroscopic action. Even to such javelin-like seeds the wind may be of service, if not in carrying them to a distance, at least in helping them to force their way through matted grass to the soil. The transport of an aristate grain may also be indirectly brought about by the action of the wind. Suppose a grain of barley to fall on a waving field of its own species. If the crop is close the seed will float almost as if on water, and, in consequence of its barbed awn, be borne along, washed by waves, as it were, towards the margin or thinner portions of the field. The movements of the stalks, acting on the barbs of the awn when it once begins to descend, will cause the seed to force a passage to the soil, into which it may even penetrate some little distance by the same kind of action. The awns of *Erodium, Anemone, Clematis,* etc., are useful in this way. It may therefore reasonably be supposed that the awn of a grass to some extent serves the same purpose.

Comparing these elongated seeds with the broad-winged samara of *Acer*, we are reminded of a corresponding distinction in the animal kingdom. The body of a bird is, in general, short, but its expanded wings give great breadth. This shape is convenient enough for a creature which moves

through a medium like air that offers but little resistance. The narrow elongated body of a snake, eel, or worm, on the other hand, is more convenient for an animal which has to make its way between the stems of reeds, or through a much-resisting medium like the soil. To keep a bird in a cage is a very simple matter, but a worm or a serpent would easily escape. Elongated, and especially aristate, seeds have the same advantage as the snake in the cage—they can effect their passage through narrow openings, as between matted grass-stems which cover the soil with a network impenetrable to winged seeds and fruits. For this reason in a hay-loft the seeds always accumulate on the floor, affording a fresh illustration of the proverbial difficulty of finding a needle in a hay-stack. Penetration is favoured by the presence of an awn-like appendage, by a barbed or scabrid surface, and by a fusiform shape. Reverting for a moment to the analogy between the dispersion of seeds and the postal system, dissemination may be said to involve three distinct processes, viz., despatch, transport, and delivery. Despatch is mostly effected by hygroscopic action, as in the opening of seed-capsules, the explosive dehiscence of the anthers in *Urtica* and *Parietaria*, the spreading of the pappus-hairs in *Carduus*, etc. Other contrivances for facilitating despatch are seen in the long filaments of grasses, *Plantago*, *Thalictrum*, etc.; in the pendulous catkins of *Quercus*; and in the slender pedicels of *Rumex* and *Briza*. During the flowering period the stalk of *Tussilago*, as we have seen, is erect. It curves over after fertilisation, and remains with the capitulum inverted until the fruits are ripe, when it again becomes erect for the purpose of exposing the plumed seeds to the wind. These and similar contrivances for despatch, might be compared to the mail-bags hung up from signal-posts on our railway lines from which the express train sweeps them off into the net as it rushes past. Contrivances for

transport are exemplified in the wings of samaroid fruits and in the hairs and feathers developed on so many seeds. Among the arrangements facilitating delivery may be included feathery stigmas, easily detached pappus, a beak on the fruit, and hooks, projecting points, or scabrid surfaces. We purposely keep out of view for the present the circumstance that awns, hooks, projections, and a hispid surface are characteristic of seeds adapted for dispersion through animal agency, because we wish to insist strongly that these have an important function to perform even in the case of seeds adapted for wind-dispersion. Of this we have ample evidence in the beak and barbs of the dandelion-fruit, which, as we have seen, help it to arrest its flight and assist it in penetrating to the soil.

IX.

# *ON THE CONDITION OF THE AUDITORY OSSICLES OF A SYNOTIC CYCLOPIAN LAMB.*

BY R. BROOM, B.SC.

[Read 30th April, 1889.]

Through the kindness of Mr. Henry M'Culloch, the well-known preserver of animals and birds, I recently obtained the skull of a synotic cyclopian lamb. A number of similar monsters have been described from time to time, but I do not think sufficient attention has been given to the condition of the auditory ossicles in this form of abnormality, as such an examination throws some light on the origin of these bones.

Before describing the ossicles in detail, I think it better to give a short account of the structure of the skull in general. This consists of a well-developed cranium with a median orbit, and with most of the anterior and inferior parts altogether abnormal.

The large orbit is very shallow, and is bounded behind by the flat undivided median orbitosphenoid, which is present as an inverted triangular plate with the optic foramen in the middle line a little above the inferior angle, and with the sphenoidal fissures at the sides. In the upper half the orbit is bounded by the frontal; in the lower, by the united malars and by a thin fascia separating it from the united temporal fossæ.

The lower jaws are entirely absent, and the facial bones are reduced to a small triangular bony mass

projecting downwards and forwards from the anterior extremity of the united malars. The anterior angle is tipped with a small irregular mass of cartilage probably representing the nasal cartilages. Owing to the maxillæ being almost entirely absent and displaced, the malars and squamosals are anchylosed with those of the opposite side along what should have been the malar-maxillary suture and the inferior edge of the zygomatic arch.

The temporal fossæ are fairly well formed on either side, and communicate with one another between the median zygomatic arch and the base of the skull. Though the lower jaw is absent, the temporal muscle is well formed. The fibres of the one side for the most part blend with those of the other, but a number are inserted into the upper side of the malar and under side of the base of the skull.

The occipital bones and the periotics are practically normal. The squamosals, which are articulated normally with the periotics, form flat bony expansions which articulate laterally with the parietals and are anchylosed together in the middle line. Anteriorly this compound squamosal is connected by suture with the united malars, the two together forming an arch over the conjoined temporal fossæ. In the middle line behind, the united squamosals rest on the basisphenoid.

From the one periotic to the other there passes a strong semi-circular arch of bone—the conjoined tympanics, the ends articulating with the cranium representing the posterior ends of the two tympanics. Across this arch of bone is stretched the tympanic membrane, in which lie the manubria of the two mallei. In front of the membrane, and laterally, is situated the common tympanic cavity, to some extent roofed over by bony plates projecting from the squamosals. In this cavity lie the ossicles.

The condition of the ossicles is perhaps the most interesting point connected with the skull. The

incus on both sides is anchylosed to the malleus, and the two mallei are closely united by a bony expansion formed of the processus graciles and the flattened-out capitula. Accordingly, the four ossicles are united into one piece, which is situated considerably to the left of the middle line. Each malleus is fairly normal in shape, though somewhat larger than usual. The manubria project downwards, inclining slightly towards each other, and are a little more curved than usual. The large depression which is normally present above the processus brevis is united with the corresponding one of the other side to form a groove along the connecting plate of bone. The capitulum is so altered, by being flattened-out and firmly anchylosed with the incus and with its neighbour on the other side, as to be scarcely recognisable as such.

Each incus is considerably modified by being flattened-out and elongated. On the left side the processus brevis forms a stout process which tapers away to a point, to which is attached the ligament of the incus. The other process, which ought to be attached to the stapes, is altogether abnormal in shape. It is present as a short, stout, irregular projection, with a small process passing for a short distance alongside of and parallel to the processus brevis. On the right side the processus brevis is considerably shorter, and the irregular bony projection corresponding to the processus orbicularis much smaller in size than on the left.

On both sides the stapes is present in the fenestra ovalis, and as each incus is situated near the middle line, on neither side is there any connection between the stapes and the incus. On the left side they are about $\frac{1}{8}$ inch apart, and on the right almost $\frac{1}{2}$ inch. Whether as the result of this or not, the stapes of the one side is quite different from that of the other. On the left side it is almost normal in shape, except that the head, instead of being flattened, forms a point, and that the whole bone is

slightly more elongated than usual. On the right side the hyoid cartilage is attached somewhat farther forward than usual, and the stapes, quite abnormal in shape, has its head attached to the side of the hyoid cartilage. The base of the stapes is rounded, and being smaller than normal, lies loosely in the fenestra ovalis. The crura are united to form an elongated cylindrical body about $\frac{3}{16}$ inch in length. The head is of considerable size and flattened-out, clasps the hyoid cartilage, passing chiefly to the inside.

As the stapes is in its normal situation and has no connection with the incus, either the stapes has been formed apart from the incus or the incus has been displaced after the formation of the stapes; but since the incudes and mallei are closely united near the middle line, and since from the mode of union of the mallei being such that there can never have been a wide separation of these bones, one is forced to admit the former of the two views as alone tenable, viz., *that the stapes has been formed in the fenestra ovalis and apart from the incus.* Although on the right side there is a connection between the stapes and the hyoid cartilage, this would appear to be secondary, since the stapes has had its head shaped to suit the previously formed hyoid cartilage. On this side the stapes has come into contact with the hyoid, owing to the hyoid being slightly displaced. On the other side there is no connection whatever between the stapes and hyoid arch.

The position of the incus would at first sight seem to imply that it had been formed in connection with the malleus; but from the hyoid arch being slightly abnormal in its attachment to the cranium, while the rest of the arch is perfectly normal, it is probable that this slight alteration in position is due to the upper end of the hyoid having been early displaced by having been connected with the abnormally placed malleus through the incus, and, after separating from the incus, being unable to attach itself

normally to the periotic on the right side. And this view is further borne out by the fact that on the left side, where the incus is only slightly displaced, the attachment of the hyoid cartilage to the skull is practically normal.

It will thus be seen that while the facts connected with the ossicles give no evidence as between the views of Parker and Fraser with regard to the development of the stapes, they are strongly in favour of the stapes having been formed in the fenestra ovalis and apart from either the mandibular or hyoid arches.

X.

# *NOTES ON SOME FRESH-WATER, BRACKISH-WATER, AND MARINE ENTOMOSTRACA NEW TO THE FAUNA OF ORKNEY.*

BY THOMAS SCOTT, F.L.S.,
NATURALIST TO THE FISHERY BOARD FOR SCOTLAND.

[Read 29th October, 1889.]

DURING July of the present year (1889), I was engaged carrying out some investigations among the Orkney Islands, on behalf of the Scientific Committee of the Fishery Board for Scotland, and took the opportunity while there to collect, by hand-net and dredge, a quantity of fresh-water and marine organisms, including a number of Entomostraca. I now propose, in the following notes, to refer to a few species of Ostracoda obtained in this way which do not appear to have been previously recorded from these islands.

## 1. FRESH-WATER AND BRACKISH-WATER SPECIES.

I was able on only one occasion to make a passing examination of the Fresh- and Brackish-water Entomostracan fauna, viz., on the Saturday evening previous to our departure for the Firth of Forth. We had anchored near Stromness, and about 5.30 p.m. I went ashore, taking with me one of our smaller tow-nets, my intention being to visit the famous "Standing Stones of Stenness" said to be distant from Stromness about six miles, and to take a look at the flora of the district and try a dip with the tow-net in any suitable ditch or other fresh-water

locality observed on the way, while at the same time keeping in view that it was desirable to be on board our steamer again about ten o'clock.

Leaving Stromness by the Kirkwall road, I ere long reached the side of Loch Stenness. The scenery along the shores of this loch is rather tame and uninviting to those familiar with our Highland landscapes; but its interesting associations with the dim past more than compensate for its tameness, for here the old Vikings, in all their rude strength and fearless courage, dominated the land.

Crossing the bridge that spans the outlet of Loch Stenness, I proceeded eastward along the highway leading to Kirkwall as far as the road that strikes off northward across the so-called "Bridge of Brogar" which divides Loch Stenness into two parts, the lower part being recognised as Loch Stenness proper while the upper part is known as Loch Harray. The water in the vicinity of the "Bridge" is rather brackish, but is fresh or nearly so at the upper end of Loch Harray.

A few of the stones, and these considerably the tallest, are met with before the "Bridge" is reached, but the famous circle is situated a good distance beyond its further or north end. Of the stones comprising the circle, 16, large and small, are still standing, while many are lying prone. The circle is of great extent, being about 400 yards in diameter, and the mound and fosse (or trench) surrounding it are still well-defined, especially the latter. The stones bear ample evidence of hoary age, and well they may, for we see them looming up through the mists of uncertainty that form the borderland of authentic history as even then the memorials of an unknown past. We stand beside the old grey lichen-covered stones, and try to peer into the impenetrable gloom and catch perchance a glimpse, though only of the shadowy outline, of the men who, either by some ingenious though doubtless rude contrivance or by mere physical strength, set these ponderous

slabs on end. We think of the numberless generations that have existed and passed away since that far-off time, while like lone sentinels these monuments have stood through sunshine and storm telling of the insignificance of human life, and the old question imperceptibly forces itself upon the mind—"What is man that Thou art mindful of him, or the son of man that Thou shouldest visit him?" As we turn away, a gleam of encouragement strikes athwart these gloomy reveries with the thought that the good as well as the "evil that men do lives after them," even though their personality be lost in oblivion.

Whether this and similar circles were formed for religious purposes, or for commemorating some great battle, or in honour of some great hero, is only matter of conjecture and seems likely to remain so; but the stones themselves will continue to be viewed by the ignorant with superstitious awe, while, to the intelligent and devout mind, thoughts full of interest and instruction will be suggested. Numerous other stones, mostly solitary, are scattered over this part of the mainland, all of which appear to be of equally ancient date; and possibly many of these single stones may be monumental in their significance.

At the south end of the "Bridge of Brogar," and on both sides of it, were some shallow weedy pools, and a ditch by the side of the road leading down to it that had the appearance of being suitable habitats for Entomostraca. These were the only places I had time to try my tow-net in. On examining the material collected in these places, I found that besides other things there were at least ten species of Ostracoda, which are as follows:

*Cypria ophthalmica* (Jurine) (= *Cypris compressa*, Baird).
" *lævis* (C. F. Müller) (= *Cypris ovum*, Jurine)
" *serena* (Koch) (= *Cypris lævis*, Brady).
*Cypris prasina*, Fischer (= *Cypris salina*, Brady).

*Potamocypris fulva*, Brady.
*Candona candida* (Müller).
„ *pubescens* (Koch) (= *Candona compressa*, Brady, and *C. albicans*, Brady).
„ *Kingsleii*, B. and R.
*Ilyocypris gibba* (Ramdohr) (= *Cypris gibba*, Ramdohr).
*Cytheridea torosa* (Jones).

Of the above the following are additions to the Fauna of the Orkney Islands:

### **Cypris prasina**, Fischer.

*Cypris prasina*, Fischer, Beitrag zur Kenntniss der Ostrac., p. 644, pl. xix., figs. 9-12 (1853).
„ *salina*, Brady, Mon. Rec. Brit. Ostrac., p. 368, pl. xxvi., figs. 8-13 (1868).
„ *prasina*, Brady and Norman, Mon. M. and Fw. Ostrac. of the N. Atlantic and N.W. Europe, p. 78 (1889).

*Habitat.*—In pools in the vicinity of the north end of the "Bridge of Brogar"; frequent.

Hitherto this species does not seem to have been observed in Scotland further north than the Island of Lewis. Clyde localities are—Hunterston (Ayrshire), and Cumbrae (*Robertson*); Langbank (*Scott*). Also within highwater mark, Aberlady Bay, Firth of Forth (*Scott*).

### **Candona pubescens** (Koch).

*Cypris pubescens*, Koch, Deutschlands Crustaceen, etc., H. 11, p. 5 (1837).
*Candona compressa*, Brady, op. cit., p. 382, pl. xxvi., figs. 22-27.
„ *albicans*, Brady, op. cit., p. 381, pl. xxv., figs 20 25 (junior).
„ *pubescens*, Brady and Norman, op. cit., p. 101, pl. xii., figs. 32-37.

*Habitat.*—Ditch by the side of the road leading down to the "Bridge of Brogar"; frequent.

Though this species has been found in many places in the Lowlands of Scotland, this is the first record of its occurrence so far north. It is found in many Clydesdale localities and in the Forth district.

**Candona Kingsleii**, Brady and Robertson.

*Candona Kingsleii*, B. and R., Ann. and Mag. Nat. Hist., Ser. iv., vol. vi., p. 17, pl. ix., figs. 9-12 (1870).
,, ,, Brady and Norman, op. cit., p. 102, pl. ix., figs. 19-22; pl. xiii., fig. 19.

*Habitat.*—With the last; rather rare.

The most northerly limit of distribution hitherto observed for this species in Scotland seems to be the Island of Lewis. In Clydesdale and the Forth district it has been observed in a number of localities.

**Cytheridea torosa** (Jones).

*Candona torosa*, Jones, Ann. and Mag. Nat. Hist., Ser. ii., vol. vi., p. 27, pl. iii., fig. 6.
*Cytheridea* ,, Brady and Norman, op. cit., p. 175.

*Habitat.*—In the pools with *Cypris prasina*; common.

Though the Clyde district seems to have been hitherto looked upon as the northern limit of this species in Scotland, I have observed it in the vicinity of Montrose Basin, as well as in Orkney. It has been found near Kilwinning in great abundance by Mr. Robertson. It has been obtained by me at Langbank, and near Port-Bannatyne, Bute, as well as in the Firth of Forth district.

Although these are the only additions, as regards the fresh-water and brackish-water species of Ostracoda, that I am able to record at present, it is highly probable that if the inland waters of these islands were more thoroughly examined, an additional number of new records would be obtained.

It may be worth while to mention here that the mollusc *Neretina fluviatilis*, recorded long ago as occurring in Loch Stenness, is still quite common there, but none of the specimens obtained by me were so large as those I have from England.

2. Marine Species.

There were comparatively few opportunities for dredging during the time we were at the Orkneys (and few of the Ostracoda can be got without the use of

the dredge), still the following records, if few, tend to show that although a good deal has already been done towards working out the marine fauna of these islands, yet a judicious use of the dredge will still yield results sufficient to reward the painstaking investigator. The species observed by me that do not seem to have been previously recorded for these islands are as follows:

**Pontocypris acupunctata**, Brady.

*Pontocypris acupunctata*, Brady, Mon. Rec. Brit. Ostrac., p. 386, pl. xxiv., figs. 53-56 (1868).
,, ,, Brady and Norman, op. cit., p. 109.

*Habitat.*—Near the mouth of Holm Sound; rare.

The only other Scottish localities recorded for this species are the Minch; St. Magnus Bay, Shetland; and Firth of Forth.

**Cythere robertsoni**, Brady.

*Cythere robertsoni*, Brady, Ann. and Mag. Nat. Hist., Ser. iv., vol. ii., p. 33, pl. iv., figs. 5, 8-10 (1868).
,, ,, Brady and Norman, op. cit., p. 139, pl. xiv., figs. 32, 33.

*Habitat.*—Near the mouth of Holm Sound, south of Deerness, in 12 fathoms; not common.

This is a distinct though small species. With regard to its distribution, Drs. Brady and Norman say: "We have no record of this pretty and well-marked species from any part of the Scottish coast north of Loch Fyne."*

**Cythere navicula**, Norman.

*Cythere navicula*, Norman, Last Report Dredging among the Shetland Isles, Brit. Assoc. Report, p. 292 (1868).
,, ,, Brady and Norman, op. cit., p. 143, pl. xvi., figs. 15, 16.

*Habitat.*—With the last.

The only other Scottish localities where this species has been observed are the Firth of Forth; the Minch; Papa, and St. Magnus Bay, Shetland.

* Mon. M. and Fw. Ostrac. of the N. Atlantic and N.W. Europe, p. 140 (1889).

### **Cythere cluthæ**, Brady, Crosskey, and Robertson.

*Cythere cluthæ*, B. C. and R., Mon. Post-tert. Entom., p. 153, pl. xiii., figs. 16, 17 (1874).
,, ,, Brady and Norman, op. cit., p. 145, pl. xiv., figs. 25-27 ; pl. xvii., figs. 35, 36.

*Habitat.*—Stromness Bay, three to four fathoms, bottom mud ; rare.

The only other Scotch locality where this species has been observed alive is Loch Fyne, where I dredged it in 1886.

### **Loxoconcho fragilis**, G. O. Sars.

*Loxoconcho fragilis*, Brady and Robertson, Ann. and Mag. Nat. Hist., Ser. iv., vol. vi., p. 24, pl. x., fig. 3 (1870).
,, ,, Brady and Norman, op. cit., p. 187, pl. xvii., figs. 32-34.

*Habitat.*—With the last ; rare.

The only Scottish localities where this species has been observed hitherto are the Clyde at Greenock (where I have also dredged it); the Firth of Forth; and Montrose Basin.

### **Xestoleberis aurantia**, Baird.

*Cythere aurantia*, Baird, Mag. Zool. and Bot., vol. ii., p. 143, tab. v., fig. 26 (1835).
*Xestoleberis* ,, Brady, Mon. Rec. Brit. Ostrac., p. 437, pl. xxvii., figs. 34-37; pl. xxix., fig. 6 (1868).
,, ,, Brady and Norman, op. cit., p. 188.

*Habitat.*—South of Deerness, near the entrance to Holm Sound.

This species has been recorded from Shetland, but otherwise the most northerly localities where it seems to have been observed are the Moray Firth and Loch Carron.

### **Cytherura producta**, Brady.

*Cytherura producta*, Brady, Mon. Rec. Brit. Ostrac., p. 443, pl. xxxii., figs. 60, 61 (1868).
,, ,, Brady and Norman, op. cit., p. 199, pl. xix., figs. 5, 6.

*Habitat.*—With the last ; rather rare.

The only other Scottish localities for which this species has been recorded are the Clyde; the Minch; the Firth of Forth; and Shetland.

**Cytheropteron depressum,** Brady and Norman.

*Cytheropteron subcircinatum,* Brady, Mon. Rec. Brit. Ostrac., p. 447, pl. xxxiv., figs. 39-42 (1868). (Non *Cy. subcircinatum,* G. O. Sars.)
,, *depressum,* Brady and Norman, op. cit., p. 218, pl. 20, figs. 22, 23.

*Habitat.*—Near the entrance to Holm Sound.

The only other Scottish localities I know for this species are the Firth of Forth and the Moray Firth.

**Bythocythere turgida,** G. O. Sars.

*Bythocythere turgida,* G. O. Sars, Oversight af Norges Marine Ostracoder, p. 84.
,, ,, Brady and Norman, op. cit., p. 221.

*Habitat.*—Near the entrance to Holm Sound.

Other Scottish localities where this species has been observed are the Firth of Clyde; Firth of Forth (*Scott*); and Shetland. It does not seem to be so generally distributed as some of the others.

**Bythocythere simplex** (Norman).

*Cythere simplex,* Norman, Nat. Hist. Trans. Northumb. and Durh., vol. 1, p. 17, pl. v., figs. 1-4.
*Bythocythere* ,, Brady and Norman, op. cit , p. 224, pl. xxiii., fig. 9.

*Habitat.*—With the last; rather rare.

This seems to be more widely distributed than *B. turgida.* It has been observed in the following Scottish localities: the Clyde (in several places); the Minch; Firth of Forth (*Scott*); Aberdeenshire coast; and Shetland.

**Paradoxostoma hibernicum,** Brady.

*Paradoxostoma hibernicum,* Brady, Mon. Rec. Brit. Ostrac., p. 460, pl. xxxv., figs, 35, 36; and pl. xl., fig. 7 (1868).
,, ,, Brady and Norman, op. cit., p. 232, pl. xxi., figs. 15-17.

*Habitat.*—Outside of Holm Sound; not common.

This species has been recorded from the Clyde and from Loch Carron. I have also lately observed it in the Firth of Forth.

### **Paradoxostoma arcuatum**, Brady.

*Paradoxostoma arcuatum*, Brady, op cit., p 461, pl. xxxv., figs. 37, 38.
" " Brady and Norman, op. cit., p. 234, pl. xxi, figs. 5, 6.

*Habitat.*—With the last.

This does not seem to be a common species, the only Scottish localities for which it has been recorded are the Firth of Forth; the Moray Firth; and St. Magnus Bay, Shetland.

### **Asterope mariæ** (Baird).

*Cypridina mariæ*, Baird, Proc. Zool. Soc. Lond., part xviii., p. 257, pl. xvii, figs. 5-7 (1850).
*Cylindroleberis* " Brady, op. cit., p. 465, pl. xxxiii., figs. 18-22; pl. xli., fig 1.
*Asterope* " Robertson, Fauna and Flora of the West of Scotland, p. 39 (1876).

*Habitat.*—Vera Sound; not common.

This species has been observed at Shetland; Skye; the Clyde; and the Moray Firth.

### **Asterope teres** (Norman).

*Cypridina teres*, Norman, Ann. and Mag. Nat Hist., vol viii., pl. xiv., fig. 10 (1861).
*Cylindroleberis teres*, Brady, op. cit., p 465, pl. xxxiii., figs. 6-9; pl. xli., fig. 2.
*Asterope* " Robertson, Fauna and Flora of the West of Scotland, p. 39 (1876).

*Habitat.*—In the same locality as the last.

This species is not so common as the preceding. The only other Scottish records I can find for it are the Clyde (one or two places) and Oban.

### **Polycope compressa**, Brady and Robertson.

*Polycope compressa*, B. and R., Ann. and Mag. Nat. Hist., p. 372, pl. xxi (1869).

*Habitat.*—Near the entrance to Holm Sound; rather rare.

The only other Scottish localities I know of where this species has been observed are the Firth of Forth and the Moray Firth.

In preparing these notes I have consulted the *Monograph of the Recent British Ostracoda* (1868), by Dr. G. S. Brady, and the *Monograph of the Marine and Fresh-water Ostracoda of the North Atlantic and North-western Europe* (1889) by Drs. Brady and Norman. I am also much indebted to my kind friend Dr. G. S. Brady, who has on this and many other occasions assisted me by looking over my collections and identifying obscure and difficult species.

XI.

# *THE DISPERSION OF SEEDS AND SPORES.*

BY REV. ALEX. S. WILSON, M.A., B.Sc.

## *PART II.*

[Read 24th September, 1889.]

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6. **Insects.**—Many animals aid in the dispersion of plant germs, but insects are by far the most important of these. It is almost exclusively as carriers of pollen, however, that they are serviceable to plants. In the vast majority of flowering-plants it is by the instrumentality of winged insects that the distribution and delivery of the pollen is effected. The insects of most importance in relation to the cross-fertilisation of flowers are bees, butterflies, moths, and in a less degree wasps, flies, and beetles. The whole floral apparatus—the honey, odour, and brilliant colours, as well as the shape of the flower and the position of its parts—have reference to the visits of insects, and tend to promote cross-fertilisation through their agency. Among the Cryptogams we know as yet of no instance in which fertilisation is effected by animal agency, unless we regard the Florideæ as an exception. Insects are so abundant in almost every situation that it is not beyond the limit of possibility that there may exist fungi which depend on special insects for the distribution of their sperm-cells. Insects are at least known to assist in dispersing the germs of certain parasitic organisms. Many diseases are communicated by flies. Indeed, it is not improbable that they may often be to blame for the spread of infection.

Eastern travellers know to their cost how flies communicate ophthalmic disease. Darwin speaks of seeds being transported over seas in earth adhering to the feet of birds. It is at least as likely that flies which revel amid putrid substances may occasionally convey spores in similar fashion. Almost all insects are liable to be attacked by parasitic fungi. The remarkable case of the New Zealand moth, the caterpillar of which, when it buries itself among moss to undergo its metamorphosis, is attacked by a species of *Sphæria* (*S. Robertsii*), has given rise to the notion that the insect develops into a plant. Wasps, bees, and flies are sometimes seen carrying about with them fungoid growths, no doubt with their complement of spores. The disease of the silkworm is caused by the fungus *Botrytis bassiana.* A fungus which preys on the common house-fly is supposed to have close relations with another which causes disease in salmon, perch, and other fish. When we take into account the frequency with which insects are attacked by fungi, and when we consider the remarkable transitions which such parasitic fungi as *Puccinia* undergo—spending one part of their existence on one host plant and another on a totally different one—it may well be that insects stand in a much closer relationship to these plants than has hitherto been suspected. Of what use, it may be asked, are the brilliant hues of the amethyst *Clavaria*, the fly Agaric, or the peacock fungus? Are the yellow, orange, scarlet, and purple tints of fungi and lichens meaningless? That some of them may be protective or warning colours is indeed probable, but that they are so in every case seems incredible. Several, again, emit agreeable odours, such as the truffles, *Parmelia fragrans*, and the lemon-scented fungus. And if the stench of *Phallus* and others be repulsive, the same may be said of many flowers. The gigantic *Amorphophallus Titanum*, the skunk-cabbage (*Symplocarpus fœtidus*), and other Aroids, as well as

*Rafflesia*, *Stapelia*, and other carrion-flowers, have unpleasant odours certainly meant to be attractive. It seems almost certain that some fungi do attract insects, but for what end it is impossible, in the present state of our knowledge, to say. The spores of many leaf-parasites are beset with projecting points. Echinate spores also occur in the truffle (*Tuber*), and on the fungus which infests the colt's-foot (*Tussilago*). A tuberculated surface is especially characteristic of the winter-spores of such fungus-parasites as *Melampsora betulina*, *M. populina*, etc. These tuberculations much resemble those observed on the pollen-grains of *Campanula*, the hollyhock (*Althæa rosea*), the melon (*Cucumis Melo*), and many composites. In the case of pollen-grains, a tuberculated surface serves to fasten them to the hairs of insects or to the stigmatic papillæ. It requires no great stretch of imagination to suppose that the intention is similar in these tuberculated spores. Whether insects aid in their dispersion or not, the projections will at least be of service in assisting them to cling to the plant on which they are destined to germinate and take up their abode.

Belt, in his work on the Natural History of Nicaragua, refers to an ant which cultivates a fungus for its own use in a leaf-mould which it procures by stripping off leaves from fruit-trees. In the process of storing up grass-seeds, the harvesting ant may also occasionally assist in their dispersion. In Natal, after every visitation of a locust-swarm, farmers have remarked the appearance of certain injurious weeds. From several small pellets of locust-dung sent home to him, Darwin succeeded in raising seven plants of various kinds. The transport of seeds by insect-swarms is therefore possible; and, as they are often blown great distances out to sea, by this means continental plants may frequently be introduced into oceanic islands.

7. **Dispersion by Birds.**—Humming-birds in America, sun-birds in Africa and India, the brush-tongued

parakeets or lories in the Malayan Archipelago, and the honey-eaters in Australia, visit flowers and effect cross-fertilisation pretty much as bees and butterflies do in Europe. The bird-fertilised class includes species of *Fuchsia*, *Passiflora*, *Salvia*, *Abutilon*, *Impatiens*, *Lobelia*, *Marcgravia*, *Erythrina*, *Cassia*, etc. Ornithophilous flowers are generally of large size and tubular form, and secrete abundant nectar. Their colours are extremely brilliant, scarlet being perhaps the most frequent. Such flowers are rarely produced by herbaceous plants. They occur as a rule only on shrubs and trees. There are no authentic cases of Cryptogams being dispersed by birds, though doubtless this may occasionally happen. Birds' feathers are at least liable to be attacked and destroyed by certain fungi.

Birds, however, play an important part in the dissemination of many Phanerogams. Where this mode of dispersion is employed, the adaptation is seen in the succulence, sweet taste, and bright colour of the fruit, and in the hardness, bitter taste, and emetic or purgative properties of the seed. Many of our native birds live to a large extent upon the succulent pulp of baccate and stone-fruits. The stones or seeds may either be rejected, or they may be swallowed and pass through the intestines of the bird uninjured. This ordeal would even seem to benefit the seed by facilitating its germination. It has at least been asserted on reliable authority that nutmegs which are swallowed by pigeons for the sake of the mace thrive much better if dropped by the birds than when planted by man. Only in a few cases is the succulent layer developed on the seed itself. A succulent testa occurs, however, in the pomegranate (*Punica Granatum*), in the gooseberry (*Ribes Grossularia*), in *Iris fœtidissima*, *Magnolia*, and several others. The yew (*Taxus*), the passion-flower (*Passiflora*), and one or two others have a succulent aril around the seed. More commonly the pericarp is the succulent portion. Drupes have only the

outer layers of the pericarp succulent, the endocarp being indurated and enclosing the kernel or seed. For the most part drupes are one-seeded, and the larger forms at least seem designed to be carried by a bird to a distance, where it can devour the pulp without swallowing the stones. Berries, on the other hand, have the pericarp wholly succulent; the seeds, usually numerous, are hard, and small enough to be easily swallowed. Familiar examples of drupaceous fruits are the plum, peach, cherry, mango, rasp, and bramble. Baccate fruits include the grape (*Vitis*), orange (*Citrus*), tomato (*Lycopersicum*), buckthorn (*Rhamnus*), privet (*Ligustrum*), *Solanum*, *Atropa*, *Asparagus*, *Convallaria*, *Ruscus*, etc. In these examples the berry is formed from a superior ovary. The inferior ovary develops into a baccate fruit in *Vaccinium*, *Ribes*, *Lonicera*, *Cactus*, etc. A false berry occurs in the mulberry (*Morus*), where the calyx becomes succulent, while the corolla of *Coriaria myrtifolia* is fleshy. *Hippophae* and *Elœagnus* have the achene inclosed in a succulent perianth. The fruits of the apple (*Pyrus*) and the hawthorn (*Cratœgus*) are somewhat similar. The edible portion of the strawberry is the enlarged receptacle; *Anacardium* also has a swollen, fleshy flower-stalk. In the fig the hollow peduncle inclosing the sessile florets constitutes the fruit, while the bracts assume a succulent character in *Phyllocladus*.

Fruits and parts of fruits not intended to be eaten, in all cases acquire a hard and dry character. The pulp of fruits adapted to birds is for the most part sweetly tasted from the presence of sugar. There are also present in addition organic acids and essential oils, which confer an agreeable and even delicious flavour to the fruit, and constitute an attraction to birds as powerful as the nectar of flowers is to insects. By their bright colours fruits of this description are easily recognised at a distance, and greater conspicuousness is often attained, as in the inflorescence, by the massing together of the

single fruits, as we observe in the clusters of the grape, rowan, and elderberry. The colour generally presents a strong contrast to that of the foliage; and if the fruit remain after the leaves have fallen it will challenge attention all the more as the season advances. Artists avail themselves of this contrast, and frequently introduce into snow-scenes a sprig of holly with its scarlet berries. It were sacrilegious to refer to Christmas-cards in connection with the dispersion of seeds, or we might adduce the favourite devices on these ubiquitous missives in illustration of the perfect colouring in fruits.

Compared with flowers coloured fruits exhibit less variety of tint. Perhaps the reason of this is to be found in the circumstance that for the purpose of fertilisation it is important that insects should be able easily to recognise and distinguish the different species of flowers. For dispersion it is not necessary that a bird should distinguish the species of plant or confine itself to one kind of fruit. On one occasion the writer happened to notice the fruits of the rose, honeysuckle, yew, and holly growing in close proximity, and was struck by the similarity of their hues when seen from some distance, in comparison with the distinct shades of the flowers blooming at that season.

Notwithstanding this, birds seem to perceive when fruit is ripe from the change of tint it shows. We have seen a rowan-tree stand for days and no birds come near although it was covered with berries, but directly these assumed the deep orange tinge numerous blackbirds appeared and cleared the tree in a single day.

The British flora furnishes as examples of red or orange coloured fruits the barberry (*Berberis vulgaris*), the spindle-tree (*Euonymus europæus*), the strawberry (*Fragaria vesca*), the rose (*Rosa canina*), the hawthorn (*Cratægus Oxyacantha*), the raspberry (*Rubus Idæus*), the rowan (*Pyrus Aucuparia*), the currant (*Ribes rubrum*), the dogwood (*Cornus mas*),

the elder (*Sambucus racemosa*), the guelder-rose (*Viburnum Opulus*), the honeysuckle (*Lonicera Periclymenum* and *L. Xylosteum*), the red whortleberry (*Vaccinium Vitis-Idæa*), the cranberry (*Vaccinium Oxycoccos*), the bearberry (*Arctostaphylos Uva Ursi*), the holly (*Ilex Aquifolium*), the daphne (*Daphne Mezereum*), the arum (*Arum maculatum*), the asparagus (*Asparagus officinalis*), the lily of the valley (*Convallaria majalis*), etc.

Blue or black fruits occur on the buckthorn (*Rhamnus catharticus*), the sloe (*Prunus spinosa*), the bramble (*Rubus polymorphus*), the elder (*Sambucus nigra*), the bilberry (*Vaccinium Myrtillus*), the crowberry (*Empetrum nigrum*), etc. Examples of white berries are seen in the mistletoe (*Viscum album*) and snowberry (*Symphoricarpus racemosus*).*

The prevailing colours are red, blue, purple, orange, and black. In this respect the colours of fruits differ from those of flowers. Black, though occasionally seen in violets, is rare in flowers; white, on the other hand, is common. Perhaps this difference is explained by the circumstance that night-blooming flowers are nearly all white to suit their nocturnal visitors. As very few frugivorous birds are nocturnal in their habits, we should expect a corresponding absence of pale-coloured fruits. The latter may, however, have special attractions for bats.

Cultivated fruits are very often of two colours; thus there are the red and green varieties of gooseberry, white and red strawberries, and green and purple plums and grapes. It is uncertain whether both varieties exist in a state of nature. If they do, a possible explanation would be, that while the conspicuously coloured variety is intended to be removed from the plant by birds, the green-coloured fruits may, if they fall to the earth, be sufficiently conspicuous on the ground to attract the notice of terrestrial animals, and through their agency the

*From *Text-book of General Botany*, by Dr. W. J. Behrens, revised by P. Geddes.

seeds may become dispersed. It is more probable, however, that the green variety is a product of cultivation which could not continue to maintain itself in a wild state.

Nature commonly avoids what is superfluous. Accordingly we find that in many instances only the exposed side of the fruit is brilliantly coloured, the concealed surface retaining its green colour. A peculiarity noticed in the rasp and some others is that the fruit, partially hidden by the leaves, can be seen more readily by a person standing at some distance from the bush than when close beside it. The intention seems to be to discourage birds from settling on the plant and devouring its fruits in quantity on the spot. This peculiarity compels a bird to make more numerous journeys and secures wider distribution. Further, when the bird is under the necessity of flying to a neighbouring tree to consume the fruit it has got, or to make a survey in search of more, the seeds will stand a better chance of being delivered in localities favourable to development—that is, in situations where birds are in the habit of perching, such as thickets and shaded plantations, corresponding to the habitat of the rasp and similiar plants. Wind-carried seeds, unless of minute size, would have very little chance of penetrating such sheltered situations. But the smaller a seed is, the more scanty the stock of nourishment it can afford for the development of the embryo during germination. This, to plants which affect a shady habitat, would be a decided disadvantage, and therefore the mass of the seed cannot with safety be reduced below a certain limit.

Succulent coloured fruits are especially characteristic of the order Rosaceæ to which many of our cultivated fruits belong, such as the apple, pear, medlar, quince, peach, plum, cherry, rasp, strawberry, etc. It is somewhat remarkable that while the fruits of this order are very highly specialised, the flowers belong to a comparatively simple type,

having, as a rule, separate petals and exposed honey. In some genera, such as *Alchemilla* and *Poterium*, the flowers even appear to have degenerated into the apetalous condition.

A curious arrangement is found in the *Magnolia*. Here we have an exception to the rule that one-seeded fruits do not dehisce, for the capsule of *Magnolia* opens and its single seed is thrown out. But it remains attached by its long, slender, string-like funiculus. The exterior of the seed being succulent and coloured, the object of hanging it out in this fashion is evidently that it may attract the notice of birds. *Roxburgia* hangs out its tufted seed in the same way until it is torn off by the wind.

As with insects in fertilising flowers, so with birds in dispersing seeds, the service is rendered unconsciously and unintentionally. There is the exceptional case of the moth which deliberately pollinates the stigmas of the *Yucca* flowers. To this we have a curious parallel, for it seems that in Guatemala there is a bird which is said to pick a hole in the bark of a particular tree, and to deposit therein its excrement, containing the seeds of a parasitic plant on the berries of which the bird feeds.

Glancing over the list of plants which produce succulent fruits, we observe that these are either trees or shrubs, herbaceous species being almost unrepresented. The same rule evidently applies to fruits which, as we have seen, obtains in the case of flowers requiring the assistance of birds. Fruits of this description, produced too near the ground, would not only escape the notice of birds, but would present a strong temptation to many terrestrial creatures and attract a host of enemies in no way fitted to help in dissemination. Of this we have evidence in the frequency with which cultivated strawberries are devoured by snails. Like large mellifluous flowers, succulent fruits adapted to birds

require to be placed at a distance from the ground, beyond the reach of snails, larvæ, ants, rodents, and larger quadrupeds. The prickles of the rasp and bramble are probably of quite as much use in protecting the fruit as in protecting the flowers and foliage. The contrivances Kerner has described as intended to ward off unwelcome guests from flowers may, in many instances, be of equal or greater importance as a protection to the fruit.

Succulent fruits commonly have seeds so hard that they resist the action of the mandibles, gizzard, and stomach of most birds. In drupaceous fruits the seed itself may be comparatively soft and easily injured, but it is enclosed for protection in a woody endocarp or stone. In the pomegranate, where the testa is soft, the central core of the seed is hard. In any case, the part ultimately dispersed is hard. This in the date and grape is the seed, in the strawberry and fig the fruit or achene, in the cherry, rasp, and bramble the endocarp, and in the gooseberry and currant the indurated core of the seed. Indurated seeds and fruits are not confined to those plants which employ birds in the work of dissemination. Mice, squirrels, and other small rodents consume large numbers of seeds, and where this danger has to be met it will be of the highest importance to a plant to possess hard seeds. This is perhaps the explanation of the remarkably hard nutlets of some of the Labiatæ and Boraginaceæ as also of the stone-like seeds of Brazil nut. The flinty cocci of *Lithospermum* are calculated to give even a rodent the toothache. The glassy grains of *Coix lacryma*, known as Job's-tears and used as beads, and the horny albumen of the palm *Phyteleps macrocarpa*, which furnishes vegetable ivory, are marked examples of this excessive hardness. Squirrels, from their habit of storing up nuts, may often, through accidentally dropping them, help in dispersion, but it can hardly be said that in the fruits themselves there is any obvious adaptation to this mode of

dispersion. A hard shell would seem to have been acquired as a protection to the seed, and, on the other hand, the powerful mandibles of the parrot tribe would fall to be accounted for as a provision enabling the birds to break open hard-shelled fruits. It can hardly be supposed that the service they perform by occasionally dropping a seed is sufficient compensation for the numbers they consume. We are, therefore, inclined to account for the dispersion of nuts in some other way, Possibly in the case of the hazel and acorn the contraction of the cupule may project the nut to some distance. In shape the betel-nut (*Areca oleracea*) resembles a rifle-bullet. This form is advantageous, whether a seed is to be ejected as a projectile from the contracting pericarp or to be passed through the alimentary canal of a bird or beast.

A disagreeable taste will prevent a seed being eaten by animals or swallowed along with the sweet pulp of the fruit. This is apparently the meaning of the bitter taste in the orange seeds, in one variety of almond, and in the fresh spermoderm of *Juglans*. *Cocculus indicus*, sometimes used to give bitterness to malt liquors, is the fruit of a plant belonging to the Menispermaceæ. The seeds of *Digitalis* and *Verbascum* are bitter, and those of the upas-tree (*Artocarpaceæ*) intensely so. On account of their hairy exterior the achenes of the rose are not easily swallowed. In other cases the seed has a hot pungent taste, as in the mustard (*Sinapis alba*) and other Cruciferæ. Pepper is obtained from the fruits of various orders: black pepper from *Piper nigrum* (Piperaceæ), Jamaica pepper from *Eugenia Pimenta*, a plant of the myrtle family; Cayenne pepper, Chili pepper, bird-pepper, and cardamoms from various Solanaceæ. From *Nigella sativa* (Ranunculaceæ), *Tasmannia aromatica* (Magnoliaceæ), *Xylopia aromatica* (Anonaceæ), water-peppers (Elatinaceæ), some of the Verbenaceæ, *Polygonum Hydropiper* (Polygonaceæ), and some plants of the ginger order

(Zingiberaceæ), pungent or peppery seeds are obtained.

The fruits of the guelder-rose, honeysuckle, ivy, dog-mercury, *Lobelia*, and some of the Scrophulariaceæ, possess emetic properties, so that in the event of the seeds being swallowed there is a possibility of their being vomited up again.

Most succulent fruits, such as the fig and tamarind, have a laxative tendency. Many again act as powerful purgatives, *e.g.*, *Citrullus Colocynthis*, the colocynth (Cucurbitaceæ); *Ipomœa Purga*, jalap (Convolvulaceæ); numerous Euphorbiaceæ, such as *Euphorbia Lathyris*, *Croton Tiglium*, *Ricinus communis* (castor-oil plant), and *Jatropha Curcas*, (physic-nut); *Rhamnus catharticus* (Rhamnaceæ); *Bromus catharticus* and *B. purgans* (Gramineæ). Emetic and purging seeds are not likely to remain long enough in an animal's stomach to admit of their germinating power being destroyed.

Narcotic and poisonous properties are not uncommon in seeds and fruits. We have marked instances of this in *Atropa*, *Hyoscyamus*, *Andromeda*, *Strychnos*, and in some of the Apocynaceæ and Umbelliferæ. A seed which occasions the death of any animal that swallows it might be benefited by its poisonous properties if the rich soil furnished by the decaying body of its victim were necessary for its germination. But it is hardly probable that this can be the end intended in all poisonous seeds. If any plant were systematically to poison the birds on which it depended for dispersion, one of two things must happen. Either this short-sighted policy would lead to the extermination of its benefactors, or the birds would gradually learn to avoid the fruits. In any case the plant would lose its means of dissemination, and place itself at such a disadvantage in the competition with other species as would in the long run lead to its own extinction. Further, it must be borne in mind that substances poisonous to man and certain animals are without effect on certain

others. Thus rabbits eat the leaves, and thrushes the berries, of the deadly nightshade without injury, and strychnine appears to have no injurious effects upon monkeys. It seems probable, therefore, that these poisons are produced, not for the purpose of destroying the agents concerned in dispersion (though they may be so in a few instances), but rather to keep away undesirable visitors. When a poisonous principle first began to be developed in any particular fruit, the birds which fed on it, we should naturally suppose, would become gradually inured to the poison until it had completely lost its effect. The liking of parrots for pepper-corns is in all probability an acquired taste. Immunity from particular poisons might be acquired in the same way that the strong mandibles have been developed in relation to hard-shelled fruits. Where poisoning occurs it would seem to be accidental, and should be regarded as arising from imperfect instincts, or as the inevitable concomitant of a transition stage in development towards more perfect adaptation. On the same principle we should be disposed to explain the case of those aroids which, according to Delpino, poison the snails on which they depend for fertilisation.

There are a few cases in which fruits, although not succulent, appear to depend on birds for the dispersion of their seeds. *Ophiocaryon paradoxum*, the snake-nut of Demerara, is so called on account of its peculiar coiled embryo presenting a striking resemblance to a small snake. The likeness is so marked that when the egg-like capsule is opened one involuntarily starts back from the supposed reptile. It would seem that the imitation here is intended as a deception, for if a bird seizes the seed under the impression that it has got a snake, and after carrying it some distance discovers its mistake and drops the seed, then the object of the plant—dissemination—will be attained, and that without any outlay in the shape of succulent pulp or saccharine matter.

In like manner the pod of *Scorpiurus subvillosus* has a curious resemblance to a centipede, and that of *S. vermiculatus* to a worm or caterpillar. The long hanging pods of *Trichosanthes anguina*, as its name indicates, look very much like snakes. *Biserrula pelecinus* resembles a centipede. According to Lubbock the seeds of *Abrus precatorius*, *Martynia diandra*, *Jatropha*, and *Ricinus* mimic beetles, while several lupines have spider-like seeds. The advantage of the mimicry in the rosary-bean (*Abrus*) is easily understood. The beans are bright scarlet with a black glossy patch. When the pod dehisces they are exposed to view, and attract, we shall suppose, an insectivorous bird which mistakes them for a particular kind of beetle. After carrying the bean some distance the bird discovers its error, drops the seed, and thus gratuitously disperses the seeds of *Abrus*. Other mimetic seeds may attain their object in the same way. Very possibly this explanation applies to the seed of the common British cow-wheat (*Melampyrum pratense*), which presents a strong resemblance to the larva of an insect.

The advantages of dispersion through the agency of birds are: (1) The possibility of transport across mountain-ranges and arms of the sea, which would prove effectual barriers to wind-borne seeds unless of infinitesimally small dimensions. (2) The delivery of the seeds in particular situations corresponding to the habitat of the plant. (3) This mode is preferable to wind agency where the number of individuals composing the species is limited, since fewer seeds will be lost or destroyed.

8. **Animal Agency.**—While succulent fruits in general are adapted for dispersion by birds, this does not seem to be universally the case. Many of the Cucurbitaceæ have large succulent fruits, but are indifferently adapted to bird-dispersion. The size, position, and colour of these gourd-like fruits are unfavourable to this mode of dissemination, and point rather to dispersion by large quadrupeds, accustomed

to seek their food upon the ground, and capable of swallowing considerable portions of the fruit-pulp. Green may possibly present sufficient contrast to the soil to attract the attention of an animal browsing in the neighbourhood. But a bird from a distance will not readily perceive a green-coloured fruit lying on the ground. Apples and other green fruits, after they have fallen to the earth, are much more likely to be devoured by some quadruped than by a bird. This consideration, together with the purging character of the fruits of Cucurbitaceæ, perhaps warrants our regarding them as adapted for dispersion by vegetable-feeding quadrupeds. It should be borne in mind, however, that the pumpkin, melon, and other overgrown berries of this description, have in all probability been greatly modified through long cultivation; and although we cannot fully endorse the opinion of Hildebrand that by these induced changes the fruits in question have become entirely unfitted for dispersion, we are disposed to accept this explanation in so far as it relates to the green or pale coloured varieties of grape, gooseberry, and other garden fruits before referred to.

Here, also, we may call attention to the frequency with which the larger fungi present the appearance of having been gnawed. The edible character of many plants of this order, and the fact that so many species occur chiefly, if not exclusively, on the dung of particular animals, seem to confirm the opinion of Berkeley and others that the spores of the mushroom and several Agarics, as well as those of certain Moulds, require to pass through the stomach of some graminivorous or omnivorous animal to facilitate their germination. Problems are here suggested in connection with the dispersion of fungi which well deserve the consideration of mycologists.

Undoubted evidence of adaptation to animal transport is seen in those fruits or seeds which are

provided with hooks, prickles, prongs, or a sticky exterior. These projections are of various forms, suggesting combs, hair-pins, skewers, barbed arrows, fish-hooks or grappling irons, and they readily become entangled in wool, fur, or hair. A rough surface alone, in the case of a small seed, may be sufficient to attach it to an animal's hide, as in the seeds of *Stellaria*, *Silene*, *Montia*, etc.

Appendages of this kind occur only on dry and obscurely coloured fruits, and mostly only on one-seeded portions. Lubbock points out that hooks rarely if ever occur on the seeds or fruits of trees, where they would, of course, be beyond the reach of animals. Neither are such appendages at all common on very lowly plants incapable of reaching up to those animals which are of sufficient size to be effective agents in dispersion. The bedstraw (*Galium Aparine*) has its fruit entirely beset with small epidermal hooklets. Equally minute are the hooklets on the persistent calyx of the forget-me-not (*Myosotis*). Hooklets also occur on the fruit of the nightshade (*Circæa lutetiana*). Each ridge on the fruit of the carrot (*Daucus*) is surmounted by a comb-like row of recurved teeth. The bur-parsley (*Caucalis*) and the hedge-parsley (*Torilis*) have also hooks or bristles on their fruits. The achene of *Geum* has a single hooked appendage formed from the persistent style. Agrimony has its fruit crowned with several rows of hooks. In the Bur-dock the bracts terminate in the hooks which cause the capitula so readily to adhere to one's clothes. The flower heads of the teazle and thistle, on account of their spiny bracts, might also be transported in this way, but they do not readily become detached from the stalk. This in all probability is the purpose of the fimbriate or pectinated margin on the bracts of knapweed (*Centaurea*). Grass seeds, as everyone knows, readily stick to cloth, fur, wool, etc. This property depends on the shape, roughened surface, ciliated glumes, or scabrid awn. The awn of *Hordeum* is, in fact, a

skewer which easily becomes entangled in the hairy covering of an animal. After a time, when the awn dries and becomes brittle, the seed is detached and falls to the soil. An aristate grain, on account of its penetrating power, can avail itself of the movements of any animal to which it clings, and so work its way among the wool or hair until thoroughly entangled. The hygroscopic awns of *Avena* and other grasses, which resemble *Erodium* in the power which their seeds have of burying themselves, may also act as prehensile organs. Farmers on the pampas of South America have numbers of their sheep killed annually by these burrowing grains penetrating the hides and reaching the vital organs of the animals. Centuries of cultivation have in all probability so greatly altered the cereals that very little can be inferred from their present condition They are not now found in the wild state—a circumstance which Hildebrand explains as due to their having lost through cultivation their means of dispersion, so that they are no longer able to hold their own against natural species. Several members of the order Gramineæ, such as *Poa, Holcus, Phalaris,* etc., are adapted to wind-dispersion where the paleæ serve as wings. Hairy appendages occur in *Phragmites communis, Pennisetum villosum,* and some others; and *Avena sterilis* can disperse itself by the assistance of its hygroscopic awn. These appear, however, to be exceptional cases, and grasses in general may be considered as having their seeds adapted for dispersion through the agency of animals. This, moreover, is only what we might expect when we consider the vast herds of buffaloes, deer, antelopes, and other large herbivores that still inhabit the grassy plains of Africa, and till recently roamed on the Asiatic steppes and American prairies. Nature is economical of her means, and it is reasonable to suppose that as an animal became dependent on a certain class of plants for food, it should have been utilised as an agent in their dispersion. In a

state of nature this is apparently the relation subsisting between the grasses and the larger ruminants.

Appendages by which seeds or fruits can fasten themselves to animals occur in the following genera, which we select from the list given by Hildebrand, viz.: *Galium, Myosotis, Cynoglossum, Asperugo, Echinospermum, Solenanthus, Hedysarum, Desmodium, Triumfetta, Echinella, Bunias, Succowia, Sanicula, Daucus, Orlaya, Caucalis, Torilis, Circæa, Sicyos, Calendula, Kœlpinia, Pedalium, Pavonia, Malvastrum, Harpagophytum, Martynia, Uncaria, Villarsia, Geum, Agrimonia, Polygonum, Grammocarpus, Œnanthe, Ceratophyllum, Stylosanthes, Tragœceros, Ancistrum, Bidens, Tolpis, Heterospermum, Verbesina, Acæna, Emex, Valerianella, Trapa, Rhagadiolus, Micropus, Aldama, Centrospermum, Lappa, Xanthium,* etc. Plants of the Tremandraceæ, a small Australian order, are distinguished by the presence of hooks on their seeds. But the most remarkable example of this class is undoubtedly the grapple-plant, *Harpagophytum.* The fruit of *H. procumbens* has upwards of a dozen stout flattened spines projecting an inch or two from its surface. Each spine terminates in a grapple-like arrangement of strong recurved hooks, while its sharp edges are also furnished with hooks. The late Dr. Livingstone, who observed this fruit in Africa, says its sharp spines will cut the strongest leather. These formidable fruits are accredited with causing the death of the lion. Should one of them adhere to its skin, and the lion attempt to disengage it, the fruit is almost certain to be transferred to the lion's mouth. The wounds there inflicted by the sharp spines drive the animal frantic, but every effort to get rid of the incumbrance is vain, and only results in the infliction of fresh wounds, until ultimately the animal succumbs to the torture.

Another curious case is *Martynia proboscidea.* This fruit, as figured by Lubbock, is about three inches long and resembles a pea-pod. It terminates in two long slender curved prongs exceeding the fruit

itself in length. The writer has seen a specimen of a fruit very similar to this but much larger, the prongs being six or eight inches in length. The specimen was said to have been obtained from Australian wool. In some parts of the south of Scotland this fruit is frequently preserved as a household curiosity, and is known locally as the "Devil's horns." The snake-fang seeds from the West Indies, shaped like almonds, but larger, have two recurved hooks at one end, and are occasionally seen in museums. The mericarp of *Pavonia spinifex*, a malvaceous plant, has three diverging prongs beset along their edges with backward-pointing barbs. *Triumfetta* is a genus of tropical weeds with bur-like fruits similar to those of the bedstraw. *Acæna procumbens* has several slender spines barbed at their extremities like arrows. The seed of *Villarsia*, an aquatic plant, is fringed with ciliated processes apparently intended to catch on to a passing animal.

Hooked appendages might prove a disadvantage rather than a benefit if there was any possibility of the fruit becoming detached from the mother-plant before the seeds were ripe. The fruit is therefore firmly attached to the mother plant, and only at maturity is the connection so weakened as to admit of easy separation. Moreover, the sharp points of the hooks are seldom exposed until the fruit is perfectly ripe. As long as they are unripe, the fruits of *Geum*, *Galium*, etc., have little or no adhesive power. In *Geum* and *Agrimonia* the hooked processes are at first vertical; but as the fruit ripens they spread out and bend downwards, so that the hooklets come to be exposed. The agrimony fruit is at first erect, but when ripened is inverted by the bending round of the peduncle. If the fruit be preserved for some time, the hooklets are seen to come together again as if for the purpose of tightening their grasp. During the time the seeds of the carrot are ripening, the rays of the umbel are gathered close together, the inflorescence forming

a ball and none of the hooks being exposed. Close examination of the hooklets of *Myosotis*, *Geum*, *Agrimonia*, *Torilis*, etc., shows that the point of the hook is not properly formed till the very last moment. As these slender projections dry, they not only curve and spread, but a slight torsion also occurs. On account of this twisting, the curve of the hook ceases to be circular and becomes slightly spiral, reminding one of the nutating tip of a climbing stem. The curvature of the terminal part of the catch is not all in one plane, but, like a fish-hook, the point is turned a little to one side. By this torsion of the spines their points become fully exposed, and this explains how these appendages so suddenly acquire the property of taking hold of one's clothes when the seeds are ripe.

The exterior of some seeds becomes slimy or mucilaginous when moistened, as in *Polemonium*, *Pittosporum*, *Collomia*, *Teesdalia*, *Linum*, etc. But this property does not appear to play an important part in dispersion. It serves rather to fasten the seed to the soil, and so assist the germinating radicle in penetrating downwards. Mistletoe seeds have this viscid character. The semi-parasitic habit of the plant necessitates this provision, for an ordinary dry seed, even if dropped by a bird on the branch of a tree, would almost inevitably fall off again. *Arceuthobium*, an allied genus which is parastic on junipers, throws its seeds from one tree to another, and the seed thus thrown adheres by means of its viscid surface. Apparently for the same reason several other epiphytes are provided with viscid seeds. This adhesive property is, however, occasionally utilised for dispersion by animals. Among others, Hildebrand mentions, *Carduus pycnocephalus*, *Carpesium cernuum*, *Hymenostomum Fontanesii*, *Pumilio argyrolepis*, *Ruckeria*, *Trichocline*, and the labiates *Ocymum Basilicum* and *Dracocephalum Moldavica*.

The outside of the fruit of *Linnæa borealis*, and the calyx of *Plumbago*, are studded with glandular

hairs secreting viscid matter available for dispersion. Sticky secretions also occur in connection with the seed or adjacent parts in *Pisonia aculeata*, *Bœrhavia scandens*, *B. erecta*, *Adenostemma*, *Drymaria*, *Siegesbeckia*, and others. Adhesive fruits will more easily succeed in attaching themselves to a smooth surface than hooked seeds can, so that hairless mammals and even reptiles will be available for their dispersion. These contrivances by which seeds and fruits fasten themselves to animals remind us of the sticky spores of *Sphærobolus*, and the adhesive disks by which the orchid fastens its pollen-masses to the head of an insect.

The contrivances which favour wind-dispersion shade insensibly into those which promote distribution through animal agency, and it is easy to see how the former might be transformed into the latter. Besides its pappus, so perfectly adapted for wind-dispersion, the dandelion has, as we have seen, a number of projections on the solid body of the seed; and a scabrid surface is very common on plumed seeds. The fruit of the dandelion, if the pappus be removed, will even adhere to cloth, but there can be no need for the help of animals where the fruit is so admirably adapted for wind-transport. It is of advantage to a wind-borne seed if, when it alights, it has some provision by which it can anchor itself and so come to rest. What the grapple is to the balloonist these protuberances are to a wind-driven seed. At the same time, these projections will cause the seeds readily to adhere to any animal that touches them, and in course of time this mode of dispersion might supersede the other. Should this ever happen to the dandelion, the pappus would disappear, leaving the fruit with an awn-like beak which might either persist as a skewer or be discarded as superfluous. At the same time, we should expect the hooklets to increase in size and efficiency, so as to adapt the fruit more perfectly to animal transport. It is at least highly probable that some

of the hooked and sticky class of seeds now dependent on animals for dispersion were originally plumed or winged, and that provisions at first useful in securing delivery have been turned to account in promoting transport.

By animal agency seeds are more likely to be delivered in situations favourable to development than by the wind. Herds of graminivorous creatures naturally frequent districts adapted to the growth of grasses. It is therefore an advantage if the plants can avail themselves of the animals as agents for the transport of their seeds. On treeless steppes and prairies the scarcity of birds renders coloured and pulpy fruits less available as means of dispersion. Under these circumstances a mutual advantage is reaped when plant and animal seek new pastures in company.

9. **Snails**.—According to Delpino, snails effect the fertilisation of certain flowers. The spathe of *Alocasia odora* has an upper and lower chamber. The latter, from which the odour emanates, contains the pistils. In the first stage snails are admitted to the lower chamber, but the entrance afterwards closes; and in the second stage they are only permitted to enter the upper chamber, which contains the male flowers. *Alocasia* is thus seen to be protogynous and to be fertilised with pollen from older flowers. It is Delpino's opinion that the visitors, after effecting fertilisation, are poisoned by an acrid secretion formed inside the spathe, and are so prevented from devouring the flowers. Delpino mentions a number of other Aroids fertilised in this manner. In *Rhodea japonica*, one of the Liliaceæ, the fleshy perianth seems to provide entertainment for the gasteropods, so that they are not under the necessity of injuring the essential organs of the flower. The accuracy of Delpino's conclusions in the case of this plant admits of no doubt, for its fertilisation by *Helix aspera* and *H. vermicularis* has actually been observed. The peculiar manner in

which gasteropods gnaw by means of their rasping strap-shaped tongue makes it doubtful if they swallow entire seeds, and their slow restricted movements prevent their being very efficient dispersers of adhesive seeds. On the whole, we should perhaps rather look for provisions by which seeds are protected against snails. Very possibly the tubercles on the perianth of the dock and on the carpels of *Reseda* may be intended to divert the attention of snails and caterpillars from the seeds. A spinous or prickly surface presents an insurmountable barrier to the ascent of a soft-bodied animal; but the leaves, stems, and flower-stalks of *Reseda* and *Rumex* are smooth, so that a snail can easily reach their fruits. For this reason the seeds may require some protection; and it may well be that the succulent tubercle affords the necessary protection by serving as a sop to satisfy the intruders without encroaching on the more highly cherished seeds.

10. **Human Agency.**—Besides the timber, grain, and vegetables which he cultivates, man unintentionally aids in the dispersion of numerous plants. Every great wave of migration has doubtless been accompanied by a host of vegetable camp-followers. Many common weeds have followed Europeans to the New World, the Cape, and the Australian colonies. Among these emigrants are the common shepherd's-purse, groundsel, chickweeds, docks, thistles, rye-grass, barley-grass, and many others. Foreign species are constantly being introduced with importations of grain, timber, wool, etc. There are well-known instances of foreign seeds having come to this country with the straw used to pack wine-cases. Quite a number of plants have been introduced in ships' ballast; and on the banks of streams, where imported wool is washed, strange plants are from time to time observed to have established themselves. Many escapes from cultivation also appear to have become naturalised with us. As examples of the

class of immigrants it may be sufficient to mention *Mimulus luteus*, *Claytonia alsinoides*, *Anacharis canadensis*, *Impatiens fulva*, *Senecio saracenicus*, *Reseda alba*, *Anchusa officinalis*, *Borago officinalis*, *Linum usitatissimum*, *Medicago sativa*, *Centranthus ruber*, *Alyssum calycinum*, *Corydalis lutea*, *Astrantia major*, *Coriandrum sativum*, *Phalaris canariensis*, *Doronicum*, and *Vinca*. Not a few members of our flora owe their presence in this country, or in particular districts, to the reputation they formerly enjoyed as yielding medicinal remedies. A number of these occur in the neighbourhood of ruined castles or abbeys. This class of monkish plants includes *Peucedanum Ostruthium*, *Rumex alpinus*, *Matricaria Chamomilla*, *Teucrium Chamædrys*, *Atropa Belladonna*, and possibly *Arum maculatum* and a number of others. The "culling of simples" by the herbalists among the monks and friars of a former day has left its impress on the flora of our country. Could we read aright the story of the plants around us we should probably discover that they had something to tell us of every great change that has passed over our country in the course of its history. For doubtless we have species that accompanied the Danish and Saxon invaders, as well as more aristocratic plants that came over with the Conqueror. Certain plants—*Rumex* and *Urtica* among others—occur most frequently in the vicinity of human dwellings. Children pulling fruits and flowers for playthings may account for the appearance or disappearance of certain plants round about inhabited houses. Seeds may also be conveyed by domestic animals, or be brought by birds that in winter approach near the abodes of men. And the question arises: Do there not exist seeds which have become adapted to dispersion through human agency alone? This is really not more improbable than that certain animal parasites should be confined to man. To answer this question fully would require an intimate

acquaintance with the habits of man in a state of savagery. The arts of civilisation have at least exercised an important modifying influence on many seeds and fruits. It hardly admits of doubt that most of our cereals and a great many cultivated flowers and fruits are now quite incapable of perpetuating themselves apart from human interference. In a negative sense these varieties, if they are not entitled to the rank of species, may be said to have become dependent on man for dispersion. It appears also probable that many weeds may have been modified unintentionally in the same direction, and have become through man's operations no longer capable of maintaining their existence apart from his activity. Were a country left to itself, it is reasonable to suppose that with the disappearance of the wheat, oats, and other cultivated grains, some of the weeds which invariably accompany cultivation would also disappear. The small seeds of the poppy, mustard, spurrey, and other weeds of the cornfield, are well adapted, at any rate, to take advantage of man's agricultural operations, and thus make him an unwilling agent in their dispersion. But doubtless the greater number of the changes which man has unintentionally effected on the distribution of plants are due to the alterations in soil and climate brought about by his operations. The construction of drains and mines, quarrying, and other excavations frequently turn up seeds that have long lain dormant, and give rise to changes in the flora. The cutting down of woods, the erection of buildings, the concentration of population in great centres, and the constant traffic between place and place must have led to the extermination of many species and the occupation of their places by others. One example of the changes brought about by these means — a case which came under the writer's observation lately—may be mentioned. Numerous plants of *Lepidium Draba* mysteriously appeared on a new railway embankment in a locality where the

plant was unknown before the railway operations began.

To enter fully into the changes which man has effected directly and indirectly on the indigenous floras of the various countries he inhabits would, however, be a task demanding separate treatment.

It only remains, in conclusion, to point out that these various arrangements for the dispersion of vegetable seeds owe their value not so much perhaps to the circumstance that they enable plants to take possession of new territory as to the fact that they bring about a renewal of the soil or natural rotation of crops, prevent close interbreeding, and, by the variety to which they give rise, diminish the severity of the struggle for existence on any given area. In the animal kingdom these ends are secured by the power of free and spontaneous movement enjoyed by animals but denied to vegetables. Notwithstanding this defect, these provisions for dispersion render possible that continual intercourse which takes place among the vegetable inhabitants of the earth. Passive and stationary as may seem the aspect of the vegetation in any region, our observations only require to be extended over a sufficient period to convince us that not only the individuals but even the species are ever changing, old forms migrating, new ones coming in to take their places, old relations being broken up and fresh ones established. Among the vegetable community, just as among the human population, the members of the same family in time become widely separated, and the inhabitants of any limited area of the earth's surface exhibit every variety of origin, name, and character.

XII.

# ON THE STRUCTURE OF THE ROOT-SHEATH IN HEDGEHOG-SPINES.

BY R. BROOM, M.B., C.M., B.SC.

[Read 29th October, 1889.]

THE main points of difference between the growing and fully-developed Hedgehog-Spine have long been known. But in recent years, with the exception of Lwoff,* I am not aware of any investigator having made a careful study of the details of structure of the spine and its sheath; and Lwoff, while he has made an examination of all the parts connected with the spine, has devoted most of his attention to the structure of the elements of the spine itself.

Whether a spine is an enormously developed hair, or a hair a very delicate and elongated spine, I shall not discuss at present. There can be no doubt that the two are homologous structures; but to see the exact homology it is necessary to compare the growing spine with the growing hair. In the fully grown spine, as there is no longer any need for the inner root-sheath, this undergoes degenerative changes, and the structure can no longer be made out; but in the growing spine the layers of the root-sheath are seen to perfection, and, owing to the inner sheath being developed to a much greater extent relatively than in the hair, we have in the Hedgehog special facilities for the study of the structure of the various layers.

On examining a longitudinal section of the growing spine with its sheaths, what strikes one most is the absence of a differentiated layer corresponding

* Bull. Soc. Imp. Mosc., T. lix. (1884), p. 141.

to the cuticle of the root-sheath. With this exception, the layers exactly correspond with those of the root-sheath of the hair. The outer root-sheath can be traced from the bottom of the follicle right up to the Malpighian layer of the skin. The two layers of the internal root-sheath can be traced from their origin at the base of the follicle to about three-quarters way up the follicle, where there is what may be called the *Sebaceous Recess.* This remarkable organ is formed by the root-sheath dilating and doubling on itself, forming a channel completely round the spine. The sebaceous matter is collected in this from a series of simple glands in which it is formed, and which open on the upper surface of this encircling channel. As the mature spine approaches the surface, the sebaceous glands retain their position relatively to the skin, so that they are frequently seen only a little way removed from the base of the spine. In the mature spine, however, the channel is closed and more or less obliterated.

The outer root-sheath measures on an average about $\frac{1}{400}$ of an inch in thickness, and is a direct continuation of the cells from which the spine is formed. It is a typical Malpighian layer, and is made up of about four or five rows of cells. The cells of the external row are somewhat cubical or cylindrical; the other cells are chiefly irregular polyhedra. The most internal, that is, those in contact with Henle's layer, are usually flattened. The layer is pretty uniform in thickness, except as it nears the sebaceous recess, where it is as much as $\frac{1}{300}$ to $\frac{1}{250}$ of an inch. Between this and the skin it is again thin, measuring only $\frac{1}{500}$ of an inch.

With regard to Henle's layer, I am sorry my observations are not perfectly conclusive as to its origin. I have, however, certain preparations which show an appearance almost exactly like that described by Unna* in the root-sheath of the hair;

* Archiv. f. Mikroscop. Anat., Bd. xii., p. 665.

and I think one is entitled to infer that the cells of Henle's layer are formed from a row of cells which originate at the base of the follicle. Hitherto the cells of Henle's layer have been invariably described as non-nucleated, but in the Hedgehog there may be easily seen *well marked elongated nuclei* which take on a fairly deep stain with hæmatoxylin. These nuclei can only be seen in the lower half of the follicle, and only in young spines. The cells are irregularly cylindrical in shape. I have not been able to make out from sections the fenestræ usually described in Henle's layer, but which Kölliker regards as probably due to the preparation. As in other animals, there is only a single row of cells. It is here thickest at its lower end, and, gradually thinning away, ends at the sebaceous recess. When the spine becomes nearly full grown this layer becomes broken up, and we find merely a number of irregular shrivelled cells lying between the outer root-sheath and Huxley's layer.

Huxley's layer is much better developed in the spine than in the hair. It arises with the spine from the base of the follicle, and is in reality *a part of the spine in which the cells do not undergo a horny transformation.* It usually consists of about three or four rows of elongated flattened nucleated cells. The cells are somewhat pointed at the ends and are more or less granular. Besides these ordinary cells, there are frequently seen, either singly or in small groups, much larger and highly refracting cells, which are possibly the same as Lwoff * found by teasing. They are oval in shape and have each a shrivelled nucleus. Huxley's layer gradually thins away as it approaches the sebaceous recess, where it ends abruptly. That Huxley's layer is carried up with the spine there cannot be the slightest doubt. In some of my sections the edges of the cells of the internal row are seen fitting accurately into the notches on the surface of the spine.

* Bull. Soc. Imp. Mosc., T. lix. (1884), p. 156.

With regard to the function of the layers, I may add in conclusion that the two layers of the internal root-sheath are for facilitating the outward growth of the spine. The gliding takes place between Henle's layer and the internal cells of the outer root-sheath. The external surface of Henle's layer is always perfectly smooth, whereas frequently on the internal surface the cells are seen interdigitating with those of Huxley's layer.

XIII.

# *ADDITIONAL NOTES ON THE FLORA OF WIGTOWNSHIRE, WITH NOTES ON MOFFAT AND KIRKCUDBRIGHTSHIRE PLANTS.*

BY JAMES M'ANDREW.

[Read 26th November, 1889.]

## WIGTOWNSHIRE.

In continuation of former notes on the Flora of Wigtownshire, I beg to add the following list of new records from that county of plants gathered by myself during July and August, 1889, chiefly at the Isle of Whithorn and Garliestown:

*Thalictrum flavum*—Garliestown Bay.

*Ranunculus sceleratus*—Port Yerrick.

*Lepidium ruderale*—Penkill, Garliestown.

*Thlaspi arvense*—Isle of Whithorn.

*Arenaria serpyllifolia* var. *leptoclados*—Garliestown Bay.

*Medicago lupulina*—In plenty from Orchardtown Bay southward.

*Astragalus Hypoglottis*—At Burrowhead and east of the Isle of Whithorn.

*Sanguisorba officinalis*—North of Eggerness Point.

*Æthusa Cynapium*—Drummorral Farm, Isle of Whithorn.

*Valerianella olitoria*—Port Yerrick.

*Convolvulus arvensis*—South of Whithorn and at Garliestown.

*Calamintha Clinopodium*—Garliestown Bay.

*Atriplex littoralis* var. *marina*—Garliestown Bay and south of Garliestown.

*Euphorbia exigua*—Isle Farm, Isle of Whithorn.

*Allium vineale*—South of Crugleton Castle on the heughs.

*Carex intermedia*—About the Isle of Whithorn.

*C. teretiuscula*—Prestrie Loch, etc.

*C. paniculata*—High Arrow Loch and a Loch at Cutreoch.

*C. flava* var. *cyperoides*, Marss. (= *C. Œderi*, auct. non Ehrh.)—Garliestown Curling-pond.

*Chara polyacantha*—In a Loch at Cutreoch, and in a Loch north of Burrowhead.

The Rev. James Gorrie, F.C. Manse, Sorbie, sends me other two new records from his parish, viz., *Adoxa Moschatellina* and *Viburnum Opulus*.

In addition to the above new records, I may mention the following seen by myself in that district: *Œnanthe Lachenalii, Statice limonium* var. *bahusiensis, Samolus Valerandi, Suæda maritima,* and *Carex vulpina*, about Garliestown; *Artemisia maritima*, at Port Yerrick; *Helianthemum vulgare, Spergularia rupestris, Genista tinctoria, Ulex Gallii, Ononis spinosa, Epilobium hirsutum, Crithmum maritimum, Carduus crispus, Scrophularia aquatica, Juncus maritimus, Juncus obtusiflorus, Potamogeton crispus,* and *Chara vulgaris*, all round the Isle of Whithorn. In Eggerness Wood are found *Circæa lutetiana, Solidago virgaurea, Hippophae rhamnoides,* and *Mercurialis perennis; Scirpus lacustris*, in Palmallet Pond; *Typha latifolia*, in Prestrie Loch; *Scolopendrium vulgare*, in ditches at Palmallet and Penkill; and *Asplenium Adiantum-nigrum*, all round Garliestown.

## Moffat Plants.

Mr. J. T. Johnstone gives the following as new records for the Moffat district: *Sagina procumbens* var. *spinosa, Saxifraga nivalis, Hieracium auratum, Hieracium sparsifolium,* and *Ajuga pyramidalis*.

The following plants have been recently confirmed from the Moffat district, chiefly by Mr. Johnstone: *Thalictrum minus, Silene maritima, Cerastium*

*alpinum, Saxifraga oppositifolia, Sedum Rhodiola, Saussurea alpina, Crepis succisæfolia, Hieracium pallidum, Hieracium prenanthoides, Calamintha Clinopodium, Veronica montana, Oxyria reniformis, Salix herbacea, Habenaria viridis, Festuca ovina* var. *rubra, Woodsia ilvensis, Cystopteris fragilis, Aspidium Lonchitis,* and *Nephrodium dilatatum* vars. *dumetorum, collinum,* and *tanacetifolium.*

The following plants, recorded from the Moffat district about thirty years ago, chiefly by the late Mr. John Sadler, have not been recently seen there, and await re-confirmation: *Lychnis viscaria, Alchemilla alpina, Saxifraga aizoides, Circæa alpina, Arctostaphylos Uva-ursi, Pyrola secunda** (seen within the last thirty years), *Trientalis europæa, Salix lapponum, Salix Myrsinites, Tofieldia palustris, Juncus trifidus, Juncus castaneus, Juncus triglumis, Carex rupestris, Carex rigida, Carex capillaris,* and *Lycopodium annotinum.*

## KIRKCUDBRIGHTSHIRE.

The following two plants are new records for this county:

*Hieracium sparsifolium*—Half-Mark, Carsphairn, in 1884, by Mr. Fred R. Coles.

*Hieracium holosericeum*—Milldown, Kells Hills, in 1883, by myself.

* Re-found in 1890 by Mr. J. T. Johnstone.

## XIV.

## *ENGLISH UPPER SILURIAN OSTRACODA.*

BY J. SMITH.

[Read 28th January, 1890.]

In 1871 I first visited the English Silurian strata, and brought home with me some of the decomposed shale, collected chiefly from the neighbourhood of Dudley. I found, on microscopical examination, that this contained numerous microzoa, and in some of the samples Ostracoda were rather common. At that time I did not send any notice of them to any society or magazine.

In 1879 I again visited the English Silurians, and, having collected and washed a large quantity of shale from 17 localities, I obtained a very exhaustive collection of Ostracoda. These I submitted to Professor T. Rupert Jones, F.R.S., and sent a note on them to the *Geological Magazine*, which appeared in February, 1881, Professor Jones having supplied a provisional list of the then known genera and species.* Although nothing was done towards working up the new forms until 1886, Mr. Vine of Sheffield had in the interval placed his collection of Silurian Ostracoda in the hands of Professor Jones, who, along with Dr. H. B. Holl, F.G.S., published two papers in the *Annals and Magazine of Natural History* for April and June, 1886, in which species of the genera *Beyrichia*, *Bollia*, *Klœdenia*, *Strepula*, *Placentula*, and *Primitia* were described and illustrated by three plates.† After the death of Dr. Holl, Professor Jones continued the investigation of

* *Geological Magazine*, decade ii., vol. viii. (1881), pp. 70-75.

† *Annals and Magazine of Natural History*, vol. xvii. (Fifth Series), pp. 337-363, 403-414; pl. xii.-xiv.

the genera; and in March and June, 1887, he published in the same magazine, illustrated by six plates, a description of species belonging to the genera *Macrocypris, Pontocypris, Bythocypris, Cythere, Primitia, Cytherella, Thlipsura, Octonaria, Bollia, Moorea, Xestoleberis,* and *Æchmina.** Five new genera, 57 new species, and 12 new varieties were described from the two collections.

In the autumn of 1888 I again visited the English Silurians, examining localities I had not before searched, and collecting material from 44 different places. Thirty-seven of these collections were found to contain Ostracoda in greater or lesser abundance, as shown in the Abstract appended to this paper. As was to be expected from the examination of a formation which had only before been worked for Ostracoda to a small extent by the late Dr. Holl and the late Lieutenant Henry Adrian Wyatt-Edgell, a number of new forms turned up, but these have not been looked over. There are at present known, from the English Silurians, 16 genera and 94 species and varieties of Ostracoda; but when all the localities become thoroughly wrought up, we may expect a list of perhaps about 150 species.

## Character of the Strata.

Neither in any of the Silurian Limestones, nor in the rotted cavities contained in the same (which, it may be remarked, are exceedingly few in the Wenlock Limestone, but more numerous in the Aymestry Limestone), have I been able to detect a single entomostracan; and all Mr. Vine's specimens, like my own, were obtained from the shales. It is not unlikely, however, that Ostracoda may yet be found in the limestone, as we know that they are often abundant in the Scotch Carboniferous Limestones. Many of the Silurian Limestones are very crystalline, and in these we can scarcely expect to find Ostracoda; but some of the bands, especially

**Ibid.*, vol. xix. (Fifth Series), pp. 179-194, 400-416; pl. iv.-vii., xii., xiii.

the thinner ones, are fine-grained, and we should expect Ostracoda to turn up in them. The great bulk of the species are got in the shale both above and below the Wenlock Limestone. In the shales in connection with the Aymestry Limestone, Ostracoda are either very rare or altogether absent.

The Silurian shales are generally of a yellowish colour, but possibly this colour is only confined to the strata near the outcrop of the beds, and is very likely to be the result of hydration. The shales are sometimes of a bluish or bluish-green, and in one instance of a red colour. The mineral matter which makes up the bulk of the shales is exceedingly fine-grained, and contains occasional particles of angular and well-rounded quartz; and as these particles gradually increase in quantity in a shale the microzoa gradually become fewer, both in individuals and species, although there are some rather fine-grained shales in connection with the Aymestry Limestone in which microzoa are very scarce. Minute scales of mica are more or less frequent in all the shales, and they generally increase in quantity along with the quartz-grains. The mica is generally white, sometimes brownish, and rarely brass-coloured. In one shale the microzoa were dusted over with very minute mica-scales. In many of the shales small brownish magnetic particles turned up. May these be meteoric dust? In one gathering near the Malvern Hills were small fragments of hornblend, felspar, and obsidian or pitchstone. In nearly all the shales small fragments of black scoriaceous lava were got.

The minerals above referred to have evidently been deposited along with the shales, but the following have been formed chemically after the shales were deposited: prismatic and crystallised transparent and opaque calcite; small more or less rounded white crystalline aggregates of calcite; hematite (rarely); minute cubes, spangles, and amorphous iron pyrites; and galena (in one sample). In

some of the shales were a few minute bright crystals of quartz.

Small black coprolites were pretty constantly found, though not common. *Lagenæ* in some of the shales were frequent. They have been described by Dr. H. B. Brady, F.R.S., who, in his concluding remarks on them, says: "From these gatherings we learn that at least four of the varieties of *Lagena* at present living in our seas, namely, *L. globosa*, *L. lævis*, *L. clavata*, and *L. sulcata*, have a genealogy reaching back to the upper Silurian epoch."* *Lagena lævis*, one of the plainest of its tribe, is perhaps the most conservative animal in possession of a house at the present day. The Foraminifera *Orbulina*, *Stachia*, and possibly several others which have not yet been examined, have turned up in the shales. *Archæocidaris* remains, including plates, spines, bones, and teeth, were sparingly found. Spirals were rare, and bivalves rarer still. Small rugose and incrusting corals were frequent in some shales. Polyzoa were common in many shales. In the *Quarterly Journal of the Geological Society* for April, 1882 (vol. 38, pp. 44-68), Mr. Vine has given a list of 24 species and varieties, but several still remain unnamed. The Annelida are represented by *Cornulites serpularius*, Sch., *Tentaculites annularis*, Sch., *T. tenuis*, *Ortonia*, and *Spirorbis* of several species. Small Brachiopods were abundant in many of the shales, and are possibly to a great extent the fry of the larger species. Three species of sponges, represented by their spicules, are rare in the shales, but frequent in the rotted limestone of Aymestry age near Craven Arms; these are *Astræospongia patina*, Rœmer, *Anactosella siluriensis*, Hinde, and *Hyalostelia gracilis*, Hinde.† The following Annelid-jaws, described by Dr. Hinde in the *Quarterly Journal of the Geological Society* for August, 1880 (vol. 36, pp. 368-378; pl. xiv.),

* *Geological Magazine*, November, 1888.

† See Volume XL. of Palæontographical Society's Publications (1886).

also occurred: *Eunicites curtus*, H.; *Œnonites regularis*, H.; *Œ. naviformis*, H.; *Œ. præacutus*, H.; *Œ. insignificus*, H.; *Œ. cuneatus* var. *humilis*, H.; *Œ. aspersus*, H.; *Œ. tuberculatus*, H.; *Œ. chiromorphus*, H.; *Arabellites extensus*, H.; *A. spicatus*, H.; *A. spicatus* var. *contractus*, H.; *A. obtusus*, H.; *A. anglicus*, H.; *Staurocephalites serrula*, H.; and *Neridanus antiquus*, H. Conodonts were frequent in connection with the Aymestry Limestone and Ludlow Calcareous Mudstones, but rather rare in the Wenlock shale. Minute pearls are found very sparingly in the Wenlock shales, frequently in the limestone, and commonly in the Aymestry shale. Fossil pearls have been noticed by Professor Solas, in the *Quarterly Journal of the Geological Society*, vol. xxxv. (1879); by C. Barrois, in his *Terrains Anciens des Austuries et de la Galice* (1882); by Professor John Morris, in the *Annals of Natural History* for August, 1851; one specimen from a Jurassic *Gryphæa*, others from Kent Chalk, and I have one from the Carboniferous shale of Brockley, Lanarkshire.

The Wenlock Limestone is generally of a greyish colour, sometimes rather crystalline, and some of the thinner beds are fine-grained. Often whole posts are made up of corals, and other beds are almost entirely built up of encrinites. In some of the quarries near Much Wenlock the dip is gentle, but in the Ironbridge and Dudley districts very steep, sometimes as much as 80°. There is a tendency in some of the beds to assume a nodular structure.

The Aymestry Limestone, taking it all over head, is by no means such a pure carbonate as the Wenlock. Some parts of it are almost entirely made up of the shells of the large brachiopod *Pentamerus Knightii*.

## Ostracoda.

The Silurian Ostracoda are generally of a dark greyish colour, some are earthy red, others have a

fine amber tint, and a few are snow-white. The new genera have thus been defined:

**Bollia**, Jones and Holl.

"In these Beyrichian Entomostraca the valves have two lobes meeting below with a thin curved isthmus. They have also a marginal ridge, sometimes unequally divided ventrally. By the lessening of the lobes and the increase of the marginal rim some forms seem to show a passage into Kirkbya. The simple horseshoe swelling on the valve differs as much from the *three-lobed* and the *plurijugate Beyrichiæ* and from the *corrugate* form or Klœdenia, that we propose to give this a generic standing as *Bollia*, in honour of the late Dr. Ernst Boll, of Neubrandenburg."

**Klœdenia**, Jones and Holl.

Belongs to the *Beyrichiæ corrugatæ*. The main portion of the valve is smooth and convex, sulci very short, mid lobe small but prominent, and reaching to the dorsal edge. It is bordered by a marginal rim.

**Strepula**, Jones and Holl.

"The carapace-valves are slightly convex, suboblong, with rounded ends, or semi-elliptical, that is, less boldly curved at one end than at the other, and bear narrow often trenchant ridges. These are sometimes concentric with the lower margin, in other cases partly concentric and partly irregular. They run into the slightly thickened dorsal margin. The intervening furrows form broad valleys, and a subcentral tubercle, or even a lobular swelling, is sometimes present. The chief ridge is a free supramarginal lamina, standing outwards and downwards, and hiding the real marginal edge in the side view. The edged view of the bivalved carapace is narrow-ovate, cross-barred at the sides with ridges, some straight and parallel, some oblique and divergent."

(Lat. *Strepa*, a stirrup.)

**Placentula**, Jones and Holl.

"Valves suborbicular, nearly semicircular on the ventral border, straight on the dorsal margin inside, but projecting with unequal and variable angles at the outer dorsal region. Surface flat or slightly convex, surrounded by a raised rim, which slopes down suddenly outside to the edge of the valve. This rim encloses a depressed and reticulated area, and in or near the antero-dorsal region there is a small depression defined by a raised loop-like border. Within certain bounds all these features are variable in different individuals."

(Lat. *Placentula*, a little cake.)

**Octonaria**, Jones.

"In this peculiar form of carapace the valves are subovate in outline, thick, and flattened, with variously moulded surface. The ventral margin is usually straighter than the dorsal. The superficial plateau is more or less regularly bordered by a curved ridge, within which there are one or more hollows and different elevations ; the latter are usually connected with the ridge, but sometimes isolated. The inclination shown by the ridge in many cases to turn in on itself in the ventral region, and thus more or less closely imitate a *figure-of-eight*, is the foundation for the generic name. In all cases the edge view of the carapace is much like that of *Thlipsura corpulenta*, that is, suboblong with subacute ends, the valves being nearly flat on the surface, and sloping down to the edges all round."

On some of the Silurian *Beyrichiæ*, viz., *B. tuberculata* var. *gibbosa*, Reuter, *B. Klœdeni* var. *granulata*, Jones, *B. K.* var. *intermedia*, Jones, *B. K.* var. *subtorosa*, Jones, *B. K.* var. *tuberculata*, Salter, *B. K.* var. *torosa*, Jones, and *B. Maccoyiana*, Jones, there is a large lobe, called the "hypertrophied lobe," developed towards one end of the ventral region of each valve. They have been ascribed to advanced

age, egg pockets, recesses for holding hepatic gland, and to a parasitic origin like the swelling caused by *Bopyrus* in the prawn. *Beyrichia Maccoyiana* has got a striated flange somewhat like that possessed by *Beyrichia radiata. Æchmina cuspidata* and *Æ. bovina* have curious long hollow spines situated near the middle of the valve on the dorsal region, those on *Æ. cuspidata* being as long as the valves themselves.

In 1887 Professor J. R. Jones published a list of Silurian Ostracoda sent him by Professor G. Lindstrom, of the State Museum, Stockholm. These were from the Silurian rocks of Gothland, and were referred to 33 species, 11 being identical to species from the English Silurians.

The conditions that prevailed during the deposition of the Wenlock shales must have been much the same as those that hold in the Firth of Clyde, two or three miles off Ardrossan, at the present day. With one haul of a small dredge we may bring up as much fine mud as will give us on examination 30 or 40 species of Ostracoda, and as many of Foraminifera. So amongst the Silurian Wenlock shales we may have in 10 or 12 lbs. weight of the decomposed material as many Ostracoda, but of Foraminifera we may only have one or two individuals, the more highly organised Entomostraca of these early times far outnumbering the more lowly Foraminifera. But, on the other hand, the bivalve of the present day takes the place of the more antique Brachiopod which swarmed in the muddy bottoms of the Silurian seas.

## Localities Examined.

**1. Walsal.**—The shale from this locality, collected at Blue Holes, beside the Rushall Canal, was of a greenish-blue colour. It was not very fossiliferous.

Ostracoda, 9 species.

**2. Dudley Tunnel.**—The debris from this tunnel has afforded a store-house from which many fine

Silurian fossils have been collected. Fine specimens of Chain, Pipe, Honeycomb, Sun, and other Corals are to be found here. In the gathering of greenish-blue shale taken by me from this locality were a number of minute Brachiopoda.

Ostracoda, 6 species. The rare *Beyrichia Klœdeni* var. *torosa*, and *Primitia fabulina*, were got here.

3. **Dudley Castle Grounds.**—The shale was of a dark, dirty-blue colour, and contained many well-rounded quartz-grains, minute white crystalline masses of calcite, small particles of hematite, some minute cubes of iron pyrites, Crinoids, Polyzoa, small Brachiopoda, and one pearl.

Ostracoda, 18 species. *Beyrichia Klœdeni* var. *torosa* turned up in this gathering.

4. **The Wren's Nest, near Dudley.**—The Silurian strata (Wenlock) at this famous locality have been squeezed up into a large anticlinal angle of about 80°. In certain limy layers interbedded with the shales the usual Silurian fossils are in great plenty. The shale searched was yellowish in colour, and when washed left a quantity of small hard particles that did not float off. It contained a large quantity of well-rounded quartz-grains, some minute scales of mica, a few minute pieces of black scoriaceous lava, some rounded and ovoid crystalline masses of calcite, some particles of opaque and clear calcite, a few minute magnetic particles, some Crinoids, Polyzoa, small Brachiopoda, two small black coprolites, a bone of *Archæocidaris*, one minute pearl, a few examples of *Spirorbis*, and some spicules of *Astræospongia patina*, Rœm. As the yellow Silurian shales generally waste rather freely, the reason of this one not having done so may be that the upturning of the strata possibly had something to do with the hardening of the shale in this instance. It is remarkable that the large fossils have not suffered to a greater extent.

Ostracoda, 25 species. The very rare *Beyrichia*

*Klœdeni* var. *nuda*, the scarce *Beyrichia Klœdeni* var. *clausa*, and *Bathocypris reniformis*, were got.

5. **Sedgely, near Wolverhampton** (Wenlock Shale above Limestone).—A fine-grained yellowish shale, with the usual Silurian fossils, some small Brachiopoda, Crinoids, and Polyzoa.

Ostracoda, 18 species.

6. **Sedgely** (Shale above Aymestry Limestone).—Shale rather arenaceous, with minute scales of white mica, well-rounded quartz-grains, some brown magnetic particles, some scales of brown mica (biotite), one *Lagena*, 10 pearls, part of a fish scale, three Conodonts, and worn fragments of Polyzoa. Ostracoda were rare in all the Aymestry shale I examined and other fossils were by no means common.

Ostracoda, 2 species.

7. **Lincoln Hill, Ironbridge, Shropshire.**—The Wenlock strata dip rather steeply here, and the limestone, which is exhausted in the open-cast workings, is now drawn from a pit. This limestone is to a large extent made up of Corals, and, in the cavities of the stone, mineral-grease is not unfrequent. The shale in connection with the limestone is of a yellowish colour, and contains some very minute scales of white mica (muscovite), some particles of black scoriaceous lava, a few well-rounded quartz-grains, rock-milk, iron pyrites, some minute quartz crystals, some transparent and opaque crystalline calcite, some annelid-jaws, three *Lagenæ*, one spicule of *Astræospongia patina*, Rœm., a small spiral, and a bone of *Archæocidaris*. Small Brachiopoda and Crinoids were frequent, *Spirorbis* common, and Polyzoa rare. There were also a few rugose Corals.

Ostracoda, 34 species. *Beyrichia Klœdeni* var. *tuberculata*, with big lobe, was frequent; *B. Maccoyiana*, with big lobe, was also moderately common. The locality is also one of the best for the rare *Strepula concentrica*, and *S. irregularis*, and for the very rare *Strepula beyrichioides* and *Octonaria octoformis*. The

unique *Octonaria undosa* was got here, and the rather scarce *Pontocypris Smithii* and *Bythocypris concinna* also occurred.

8. **Coalbrookdale Railway Cutting, near Coalbrookdale, Shropshire.**—This shale is of a fine yellowish colour, and is rich in microzoa. It appears to be several hundred feet under the position of the Wenlock Limestone. When the prepared material is searched under the microscope, one is a little startled to find numerous little glassy bodies of the shape of "Prince Rupert's drops," small glass globules, some with gas cavities, and scoriaceous material of a pumice-like nature. I think there can be no doubt that these little bodies have been elaborated in the fire-boxes of the locomotive engines that pass along the railway line here, and after a short career in the air, volcanic-bomb-like, they eventually find a resting-place amongst the decomposing Silurian shale, but their appearance is much too "newfangled-like" to lead them to be mistaken for products of that remote age. Interbedded with this shale is a thin band of a peculiar white substance not unlike soap. I have seen an analysis of it given somewhere, but cannot recall at present in what publication. The shale also contained some magnetic particles—if similar bodies had not been found in other districts we might have also credited the locomotive with their production,—some crystalline rounded masses of calcite, and pyrites. Fragments of Trilobites' eyes, showing the inside of the facets, were obtained. Small Brachiopoda were frequent, also "heads" of small Crinoids, *Tentaculites*, a few small rugose Corals, Polyzoa, some *Lingulæ*, part of a fish-scale, and a bivalve. It may be remarked that bivalves, either large or small, are exceedingly rare in connection with the Wenlock shales.

Ostracoda, 27 species. The Ostracoda were abundant, although the species were not so numerous as in some other localities. *Beyrichia lacunata* was

frequent; the rare *Primitia æqualis*, *Octonaria octoformis* vars. *intorta* and *informis*, the scarce *Macrocypris Vinei*, *Bythocypris reniformis*, *Bythocypris phaseolus*, and *Cythere subquadrata*, were obtained here.

**9. Ironbridge Railway-cutting, side of Severn below Benthall Edge, Ironbridge.**—Fine yellow shale about 150 feet below Wenlock Limestone. This was the most prolific in Ostracoda of all the Silurian shales examined. No fewer than 57 species and varieties were obtained. In the shale were a few well-rounded quartz-grains, some minute pieces of black scoriaceous lava, small rounded masses of crystalline calcite, clear and opaque crystalline calcite, two small fragments of fish-scales, a small spiral, and a minute *Bellerophon*. Small Brachiopoda were common, and Crinoids and Polyzoa frequent

Ostracoda, 57 species and varieties. *Beyrichia lacunata* was frequent; and among the other forms of more or less rarity obtained in this sample were *Bollia bicollina*, *B. Vinei*, *B. auricularis*, *Strepula concentrica*, *S. irregularis*, *Primitia ornata*, *P. æqualis*, *Thlipsura plicata* var. *bipunctata*, *Octonaria octoformis* vars. *simplex*, *informis*, and *persona*, *Moorea Smithii*, *Macrocypris Vinei*, *M.* (?) *alta*, *Pontocypris Mawii* var. *gibbera*, *Bythocypris Hollii*, *B. botelloides*, *Cythere* (?) *Vinei*, and *C.* (?) *subquadrata*.

**10. Benthall Edge, Ironbridge.**—This has long been a famous locality for Silurian fossils, and is specially mentioned by Murchison in *Siluria*. The yellow shale here overlies the Wenlock Limestone and contains minute iron pyrites, clear and opaque calcite, small rounded calcite masses, some minute scales of white mica, sulphate of lead, black scoriaceous lava particles, brownish magnetic particles, small black coprolites, four *Lagenæ*, two pearls, one small spiral, an *Archæocidaris* spine, and a few spicules of *Astræospongia patina*, Rœm. The peculiar broken-thread-and-star-like remains of *Ascodictyon filiforme*, Vine, *A. radiciforme*, V., *A. siluriense*, V., and *Stoma-*

*topora elongata*, V., are got incrusting Crinoids here and in the shale.

Ostracoda, 28 species. The very small Ostracoda were scarce in this gathering. The rare *Beyrichia Klœdeni* var. *granulata*, the scarce *B. Klœdeni* sub-var. *clausa*, *Strepula concentrica*, *S. irregularis*, *Primitia Rœmeriana*, *P. variolata*, *P. umbilicata*, the very rare *Thlipsura angulata*, the scarce *Macrocypris Vinei*, *M. elegans*, *Pontocypris Smithii*, *Bythocypris botelloides*, *B. testacella*, and *Cythere Vinei*, were obtained from this gathering.

11. **Wyke, Tickwood, near Much Wenlock.**—The limestone here contained a large quantity of crystalline calcite; and the man in charge of the kiln maintained that the calcite *would not make lime*, and threw it aside. This opinion is prevalent amongst the quarrymen of Scotland, who call crystals of any description "congealt water." The idea is possibly a very old one, the word crystal itself being evidently derived from the Greek word *krystallos*, ice. In the yellow shale were a few well-rounded quartz-grains, some small Brachiopoda, Polyzoa, numerous Crinoid remains, some small quartz crystals, 14 specimens of *Lagena lœvis*, some *Spirorbis*, one pearl, some spicules of *Astrœospongia patina*, Rœm., and some of *Hyalostelia gracilis*, Hinde.

Ostracoda, 15 species. These, with the exception of *Cythere Vinei*, were all of the common sorts.

12. **Gleedon Hill, near Much Wenlock.**—The fine yellowish shale from over the Wenlock Limestone contained a few well-rounded quartz-grains, some minute masses of crystalline calcite, numerous Crinoid remains, *Spirorbis*, one *Lagena*, one pearl, one minute coprolite, and some opaque and transparent calcite. The Polyzoa from this gathering were of a purple colour; could this be from fluate of lime? I have never heard of fluate of lime entering into the composition of fossils.

Ostracoda, 11 species. The rare *Bythocypris pus-*

*tulosa* was obtained, and the scarce *Pontocypris Smithii* was of frequent occurrence.

**13. Wenlock Railway-cutting, near Much Wenlock.**— Railway-cuttings through fossiliferous rocks always form a good hunting-ground. The ordinary collector is deterred from trespassing, and accordingly the spoil from such places is sometimes rather abundant. Small Brachiopoda were common in this fine yellowish shale. There were also a few examples of *Spirorbis*, and some Polyzoa.

Ostracoda, 24 species. The very rare *Beyrichia Klœdeni*, var. *intermedia* with big lobe, the scarce *Beyrichia Maccoyiana*, *Bollia bicollina*, the rare *Thlipsura tuberosa*, and the scarce *Æchmina cuspidata*, were obtained in this gathering.

**14. Shadwell, near Much Wenlock.**—The shale over Wenlock Limestone contained small masses of cubical iron pyrites, some well-rounded quartz-grains, white crystalline masses of calcite, some small quartz crystals, transparent and opaque calcite, a few scales of dark-brown mica, seven pearls, Polyzoa and Crinoid remains (common), small Brachiopoda (rare), a bone of an *Archæocidaris*, and a spicule of *Astræospongia patina*, Rœm. Many of the minute fossils from this gathering were very white, and consequently of a beautiful appearance.

Ostracoda, 10 species, which call for no special notice.

**15. Norris Quarry, near Wenlock.**—The yellowish shale from this quarry contained crystals of calcite as clear as Iceland-spar, small well-rounded masses of crystalline calcite, and rounded quartz-grains. Polyzoa were common and Crinoids frequent. Six pearls were obtained.

Ostracoda, 15 species. *Beyrichia Klœdeni* sub-var. *clausa*, and *Cythere Hollii*, were frequent.

**16. Bradleyfield, near Buildwas.**—Shale yellowish, with a few well-rounded quartz-grains, minute iron pyrites, clear and crystalline calcite, Polyzoa

(common), six pearls, and one tooth of an *Archæocidaris.*

Ostracoda, 20 species. The rare *Beyrichia tuberculata* var. *gibbosa*, the scarce *Primitia valida* var. *breviata*, and *Cythere Hollii* (the last-named in plenty), were obtained from this gathering.

17. **Ridgend, Woolhope, Herefordshire.**—In this quarry there was a large quantity of the white substance noticed as occurring in a thin bed at Coalbrookdale Railway-cutting (No. 8). I collected about 20 lbs. weight of it, and it washed almost entirely away through a buckram bag. In the residue that remained were clear and opaque crystals of calcite, and a minute black coprolite.

Ostracoda, 6 species, among which were the rare *Primitia ornata*, the very rare *Octonaria paradoxa*, and the rather scarce *Macrocypris siliquoides.*

18. **Woolhope, Herefordshire** (about a mile east from the inn on the Ledbury Road).—This locality was a very small opening in the Woolhope Limestone, situated in a wood at a little distance from the road, but I failed to find it on my last visit. Had I succeeded in finding the spot, I have no doubt that I would have increased considerably the list of Ostracoda from it, as individuals were abundant in it; and, when that is the case, a number of rarities are sure to be found, as the Silurian Ostracoda as a class appear to have been eminently social. One never finds a single species abundant to the almost total exclusion of others, as is sometimes the case in the coal measures. The shale was fine-grained and of a bluish colour. Small Brachiopoda were common, Crinoids frequent, and Polyzoa frequent and in beautiful preservation.

Ostracoda, 35 species, among which were *Beyrichia Klœdeni* var. *intermedia*, *B. Klœdeni* var. *subtorosa* with big lobe (frequent), the scarce *B. lacunata*, *Bollia bicollina*, *B. Vinei*, *Strepula concentrica*, *S. irregularis*, *Primitia umbilicata*, *P. ornata*, the rare *Octonaria octoformis* var. *intorta*, the scarce *Æch-*

*mina bovina, Pontocypris Smithii,* and *Bythocypris concinna.*

**19. Lea Wood, Fownhope, Herefordshire.**—Yellowish shale, with some particles of black scoriaceous lava, clear and opaque calcite, a few minute angular pieces of quartz, prismatic calcite, some white scales of mica, small rounded grains of crystalline calcite, one small black coprolite, a spine of a sea-urchin, some Polyzoa and Crinoid remains, a few small Brachiopoda, a spicule of *Astræospongia patina,* Rœm., and *Lagena lævis.*

Ostracoda, 20 species, including *Beyrichia tuberculata* var. *gibbosa, Bollia bicollina, Primitia ornata,* and *Bythocypris concinna* (common).

**20. Common Hill, Fownhope.**—The shale from this locality was fine-grained and yellowish, and contained some clear and opaque calcite, and minute iron pyrites.

Ostracoda, 22 species. *Primitia umbilicata,* and the very rare *Primitia cornuta,* were obtained.

**21. Dormington, near Stock Edith, Herefordshire.**—The shale was yellowish, with abundant fossils, minute pieces of black scoriaceous lava, small rounded calcite, cubic iron pyrites, some small black coprolites, Polyzoa and Crinoids (common), small Brachiopoda, interambulacral plate and a spine of *Archæocidaris, Astræospongia patina,* Rœm., six pearls, two *Lagenæ,* and *Orbulina?* Although Crinoids were common, Ostracoda were abundant, which is rather contrary to rule.

Ostracoda, 34 species. Among the species of more or less rarity were *Beyrichia Klœdeni* var. *granulata, B. Klœdeni* var. *subtorosa* with big lobe (common), *B. concinna, B. admixta* (frequent), *Strepula beyrichioides, Placentula excavata* (common), *Primitia fabulina* (common), *P. umbilicata* (frequent), *P. æqualis, P. diversa, Octonaria octoformis* var. *persona* (common), and *Cytherella Smithii*—the oldest of its genus (common).

**22. Chickley Common, between Woolhope and Dormington.**—This yellowish shale contained some small white masses of crystalline calcite, some opaque calcite, a few rounded quartz-grains, some minute mica-scales, three *Lagenæ*, five pearls, and two specimens of *Spirorbis*.

Ostracoda, 14 species. *Primitia paucipunctata*, the widespread *Thlipsura plicata* (common), and the rare *Octonaria octoformis* var. *informis*, occurred in this sample.

**23. Malvern Tunnel** (Blue shale at west end of tunnel).—This shale is greenish-blue in colour, and not so fine-grained as the Silurian shales generally are. It is rather much "barkened" to many of the smaller fossils. It contained scales of mica, minute angular pieces of mica-schist, a few well-rounded quartz-grains, some small aggregates of calcite, minute masses of cubical iron pyrites, some small *recent* calcareous concretions on plant-fibres. Polyzoa were frequent, as well as small Crinoid remains and Brachiopoda, a few casts of very small spirals, some very diminutive rugose corals, numerous minute *Tentaculites*, a spicule of *Astræospongia patina*, Rœm., and some specimens of *Stachia?*

Ostracoda, 20 species. The scarce *Beyrichia lacunata* was frequent; *Primitia valida*, frequent; *P. valida* var. *breviata*, frequent; *Macrocypris elegans*, frequent; *Cythere Hollii*, frequent. Many of the Silurian Ostracoda are remarkably well-preserved; and of this I had experience when washing the sample, as two recent fresh-water Ostracoda got mixed up with the Silurian species, and had been mounted as "fossils" before I detected the error.

**24. Malvern Tunnel** (Red shale).—This was from the same place as the last, only a short distance further from the mouth of the tunnel. Like last sample, the shale was coarse, and contained the same mineral particles. From it were obtained a minute spiral, and a spicule of *Astræospongia patina*, Rœm.

Ostracoda, 13 species, including the scarce *Moorea Smithii*, *Æchmina cuspidata* (common), *Æ. bovina* (frequent), *Macrocypris siliquoides*, *Bythocypris Hollii* (frequent), *B. reniformis* (frequent), *B. acina* (frequent).

**25. Ledbury, near the Town.**—The minute mineral particles and other matter in this shale consisted of some scales of mica (white, brown, and brass-coloured), prismatic calcite, some black scoriaceous lava, a few well-rounded quartz-grains, some fine double-pyramid quartz-crystals, a few grains of green serpentine, some clear and opaque calcite, three fine transparent pearls adhering together, a small black coprolite, a minute fish-scale, a minute fish-tooth, a Conodont, and *Orbulina?* Polyzoa, Crinoids, and small Brachiopoda were scarce.

Ostracoda, 6 species.

**26. Dog Hill, near Ledbury.**—This fine yellowish shale was rich in Ostracoda. In it were some brownish magnetic particles, rounded masses of crystalline calcite, small crystals of opaque and transparent calcite, minute scales of mica, and some minute fragments of black scoriaceous lava. Small black coprolites were frequent, and the other organic remains consisted of one sea-urchin spine, one spicule of *Astræospongia patina*, Rœm., and a minute smooth cast of a *Bellerophon*. As far as my observations have gone, whatever may be the character of the exterior of a *Bellerophon*, whether grooved or ornamented, the interior is always uniformly smooth. Small Brachiopoda were frequent, and one pearl was obtained.

Ostracoda, which were abundant as to individuals, included 29 species. Amongst these we may notice the scarce *Beyrichia Klœdeni* var. *intermedia*, *B. Maccoyiana*, *B. admixta*, *Primitia paucipunctata* (frequent), *P. obliquipunctata*, *Thlipsura corpulenta* (common), the ubiquitous *Xestoleberis corbuloides* (common), the scarce *Bythocypris phaseolus*, and *Cytherella Smithii* (frequent).

**27. Eniker, near Ledbury.**—Shale bluish-green, with a considerable quantity of minute mica-scales, some prismatic calcite, small masses of iron pyrites, clear and opaque crystalline calcite, one *Lingula*, some minute *Tentaculites*, and small Brachiopoda. The microzoa from this gathering were all dusted over with very minute scales of white mica.

The Ostracoda, of which there were only nine species, call for no special notice.

**28. Coneygree Wood, near Ledbury.**—Yellowish shale, with minute scales of white mica, some brass-coloured mica, some clear and opaque calcite, and well-rounded quartz-grains. Ten extra-small pearls, a few Polyzoa and Crinoids, and some small Brachiopoda were obtained.

Ostracoda, 13 species. *Primitia ornata* occurred in this gathering.

**29. Presthope, near Station.**—Yellowish shale, containing clear and opaque calcite (frequent), some minute black scoriaceous lava, a few rounded quartz-grains, minute aggregates of calcite, and some exceedingly small scales of white mica. In the Limestone (Wenlock) at this locality were some thin lenticular bands of chert up to one inch in thickness. The organic remains consisted of a few examples of *Lagena lævis*, two spicules of *Astræospongia patina*, Rœm., 16 spicules of *Hyalostelia gracilis*, Hinde, 32 *Lagenæ*, and one pearl.

Ostracoda, 15 species, including *Beyrichia Klœdeni* sub-var. *clausa*, *Strepula irregularis* (frequent), and *Moorea Smithii* (rare).

**30. Presthope, one mile south-west from Station.**—This quarry is situated near to the escarpment of the Wenlock Limestone called Wenlock Edge, which extends in a N.E. and S.W. direction for twenty miles and rises to a considerable height above the valley that separates it from the Longmynd Hills, four miles to the S.W. The Silurian Limestones in this district are said to measure 350 feet in thickness. The gathering of shale from this

locality was of a yellowish colour, with a large quantity of calcite. There were a few well-rounded quartz-grains, some minute mica-scales, and particles of black scoriaceous lava. Crinoids and Polyzoa were common; and there were also obtained four small black coprolites, some small Brachiopoda, four *Lagenæ*, eight pearls, and two spicules of *Hyalostelia gracilis*, Hinde.

Ostracoda, 7 species, including *Beyrichia Maccoyiana* and *Strepula concentrica.*

**31. Rock, near Mayhill, Gloucestershire.**—The Silurian Limestones in the Mayhill district are said to be in the aggregate 550 feet in thickness. The fine yellowish shale from here contained some rounded concretions of calcite, minute cubical iron pyrites, some scales of brown mica, some exceedingly minute scales of white mica $\frac{1}{330}$ of an inch in size, one spiral, three small black coprolites, small Brachiopoda (frequent), Crinoids and Polyzoa (common), a bone of an *Archæocidaris*, and one pearl.

Ostracoda, 16 species, including *Beyrichia tuberculata* var. *subtorosa* with big lobe (common), the wide-spread *Xestoleberis corbuloides* (common), *Bythocypris ? reniformis* (scarce), *B. concinna* (scarce), and *B. phaseolus* (scarce).

**32. Longhope, Gloucestershire.**—Quarry about a mile east from station. The shale here was yellowish, and contained plenty of microzoa. The mineral particles dispersed through the fine shale were small aggregates of crystalline calcite, black fragments of scoriaceous lava, and some brown mica. The organic remains consisted of one spiral, fragments of Trilobites, small Brachiopoda (frequent), Polyzoa (common), Crinoids (scarce), a minute black coprolite, and a tooth of *Archæocidaris.*

Ostracoda, 22 species. *Beyrichia Klœdeni* var. *subtorosa* was especially common, and of a fine yellowish-brown colour; many of the valves showed the interior, and five examples with the big lobe were obtained. Among the other species in this

gathering were *Beyrichia Klœdeni* var. *tuberculata* with big lobe, *B. Klœdeni* sub-var. *clausa* (frequent), *B. Maccoyiana*, *B. lacunata*, *Bollia bicollina*, *Primitia umbilicata*, and *Æchmina bovina*.

33. **Eskam Engham, about two miles from Newent, Gloucestershire.**—The shale from this locality was fine-grained and yellowish in colour, with a few minute scales of white and brownish mica, and some rounded quartz-grains, a few Crinoids, Polyzoa, and two pearls.

Ostracoda, 21 species, including *Beyrichia Klœdeni* var. *subtorosa* with big lobe, and *Primitia fabulina*. *Bythocypris Hollii* was frequent.

34. **Prisscoed, three miles from Usk, Monmouthshire.**—Shale yellow, rather sandy, with a little white and brown mica, small white calcite aggregates, opaque calcite, rounded quartz-grains, brownish magnetic particles (meteoric dust?), some minute fragments of black scoriaceous lava, a small black coprolite, and a few Crinoid remains. The larger Silurian fossils were scarce in this quarry. The common Silurian Brachiopod *Atrypa reticularis* was of extra large size here.

Ostracoda, 9 species.

35. **Glasscoed, near Little Mill, Monmouthshire.**—The shale from this quarry was yellowish, and rather sandy. The siliceous sand-grains were not well-rounded, and measured from $\frac{1}{500}$ to $\frac{1}{330}$ of an inch. The shale contained a little white and dark-brown mica, some opaque and crystalline calcite, and minute particles of black scoriaceous lava. A small black coprolite was found *in situ* in a fragment of shale, and a spicule of *Hyalostelia gracilis*, H., was obtained.

Ostracoda, 6 species, of which *Thlipsura plicata* was the only one commonly found.

36. **Stock Say, near Craven Arms, Shropshire.**—Fine yellowish Wenlock shale, with plenty of small Brachiopoda, Polyzoa, Crinoids, *Spirorbis*, and *Tentaculites*.

Ostracoda, 12 species, including *Primitia variolata*, *Bythocypris concinna*, and *B. pustulosa*.

**37. Herefordshire Beacon, half a mile west from base.**—Bluish-green shale, with minute scales of mica, angular quartz-grains, white and red aggregates of crystalline calcite, hornblend, clear and opaque calcite, some well-rounded quartz-grains, felspar, obsidian or pitch-stone, and minute particles of black scoriaceous lava. One small Brachiopod was obtained.

Ostracoda, 4 species.

### SILURIAN SHALES AND LIMESTONES IN WHICH NO OSTRACODA WERE DETECTED.

**38. Dolyhir, near Old Radnor.**—Dark-blue shale, with minute mica-scales, small aggregates of crystalline calcite, minute crystals of carbonate of copper, particles of mica-schist, small masses of dog-tooth spar, spangles of pyrite, and very bright quartz-grains. This was a very remarkable shale. There was nothing organic found in it except one or two species of Crinoids (large and frequent), and fragments of a Trilobite.

**39. Nash, two miles south from Presteign, Radnorshire.**—Decomposed yellowish shale, with some transparent crystals of calcite, fragments of mica-schist, white angular pieces of limestone, and angular bits of vitreous quartz. This gathering contained nothing organic.

**40. View Edge, near Craven Arms, Shropshire.**—This locality is rather picturesque, being situated at the end of the long valley that runs between the Longmynd Hills and Wenlock Edge Escarpment. It rises several hundred feet above the valley, and has evidently been protected from denudation by the thick beds of Aymestry Limestone that crown its summit. The shale above this limestone was of a yellowish colour, and from it were got clear crystalline calcite, small aggregates of calcite, some scales of brown mica, and very minute scales of white

mica. The organic remains consisted of one small fish-scale, a few crinoid remains, six spicules of *Hyalostelia gracilis*, H., a spicule of a glass-rod sponge, two small fish teeth, one conodont, and numerous small pearls varying in colour from opalescent milky-white to a rich amber. The limestone contains abundance of the large Brachiopod *Pentamerus Knightii.*

41. **Railway-cutting near Stock Say Castle, Shropshire.**—Yellowish shale, with minute scales of white mica, some brown mica, a few well-rounded quartz-grains, some prismatic, opaque, and transparent calcite, a few spicules of *Hyalostelia gracilis*, H., and one small fish-scale.

42. **Quarry in Upper Silurian Limestone, two miles East from Craven Arms Railway Station.** —This gathering was from rotted cavities in the limestone, and contained abundant spicules of *Astractosella siluriensis* and *Hyalostelia gracilis*, described by Dr. Hinde in Vol. XL. of the Palæontographical Society's Publications. Conodonts were common.

43. **Brow, near Norbury, Shropshire.**—This was a sample of a brownish-rusty colour from the rotted cavities in the Aymestry Limestone. The bulk of the washed material consisted of rather angular siliceous particles averaging about $\frac{1}{100}$ of an inch, a few well-rounded quartz-grains up to $\frac{1}{30}$ of an inch, and a few fragments of talc or clay slate. It is a noteworthy fact that in the shales or limestones no rounded particles of a smaller size than about $\frac{1}{160}$ of an inch have been detected, and up to $\frac{1}{100}$ of an inch they are by no means well-rounded. Apparently, when a smaller particle than this is knocked off from the parent mass, its minute size causes its floating power in water to become so great that it ceases to be capable of rolling along the bottom and having its edges worn off, and the slightest movement of the water causes it to float.

**44. Quarry one mile north-west from Wenlock.**—This was a sample of the rotted Wenlock Limestone, and contained a great many Crinoid remains and numerous minute pearls. The pearls we have noticed are more or less common in both the limestones and shales. They are of a concentric-laminated structure, translucent, and generally contain a minute nucleus. Some are silvery-white, some yellowish, and others of a fine amber colour when viewed by transmitted light. They all have a peculiar pearly lustre, and are sometimes joined together in twos and threes. I have a Carboniferous pearl from Brockley shale, but it is very much larger than any of the Silurian examples. In no case have I found them attached to the remains of any animal that we might suppose to have secreted them. I may say that in no Silurian rotted limestone have I detected Ostracoda; but in some of the Carboniferous rotted material they are sometimes pretty common.

**45. Priory Sedgley.**—The yellowish shale from above the Aymestry Limestone in this locality contained many angular quartz-grains, a quantity of well-rounded quartz-grains, small rounded masses of calcite, some white mica, and a few brownish magnetic particles. The larger fossils were very scarce, and only a few rolled Crinoid remains and fragments of Polyzoa turned up in this washing. As in most of the Aymestry shales, pearls appear to be common, 15 specimens being obtained.

**46. Longhope, near Railway Station** (Aymestry Shale).—This was a yellowish sandy shale, and contained white and brown mica, small white aggregates of calcite, some white crystallised and fibrous calcite, rock milk? brownish magnetic particles, some particles of black scoriaceous lava, 7 pearls, and a few rolled fragments of Polyzoa.

**47. White Cliff, Ludlow.**—The cliff is on the opposite side of the river from the town; and the rock is a fine-grained sandstone containing a con-

siderable quantity of lime, and in parts is very rich in many of the larger Silurian fossils. The sample gathered for microscopical examination was taken from the rotted cavities in the face of the cliff, and when washed left a large quantity of quartz-grains and white mica, a few scales of brown mica and some small calcite masses. The organic remains consisted of two spirals, one bivalve, numerous conodonts, minute dermal parts of fishes? and a few small joints of Crinoids.

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## Scottish Silurian Entomostraca.

The following Entomostraca have been recorded from the Silurian strata of Scotland:

*Beyrichia comma*, Jones.—Thrave, Girvan.
*B. impendens*, J.—Girvan, and Pentland Hills.
*B. Klœdeni*, M'Coy.—Girvan, and Muirkirk.
*B. Klœdeni* var. *scotica*, J.—Girvan.
*Cythere Aldensis*, M'Coy.—Aldons, Girvan.
*C. Aldensis* var. *major*, J.—Girvan.
*C. Grayana*, J.—Girvan.
*C. Wrightiana*, J. and H.—Girvan.
*Primitia Barrandiana*, J.—Girvan.
*Entomis tuberosa*, J.—Pentlands.
*E. Haswelliana*, J.—Pentlands.
*E. globulosa*, J.—Girvan, and Pentlands.
*E. impendens*, H.—Pentlands.
*Bolbozoe scotica*, J.—Pentlands.

See *Geological Survey of Scotland*, Explan. to Sheets 3 and 23; *Annals and Magazine of Natural History*, for 1884 and 1886; Nicholson and Etheridge's *Monograph of Girvan Silurian Fossils*, Fas. II., 1879.

(SEE ABSTRACT).

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ABSTRACT OF THE SPECIES OF UPPER SILURIAN OSTRACODA, SHOWING THE LOCALITIES FROM WHICH THEY WERE OBTAINED.

ABBREVIATIONS.

1 = Rare 1 or 2 specimens.
2 = Scarce 3 to 5 "
3 = Frequent 6 to 9 "
4 = Common, 10 or more.

* In addition to the typical form of these *Beyrichiae*, the variety with big lobe was also obtained.

Species (column heads, in order): Beyrichia tuberculata, v. gibbosa, Reuter; " Kloedeni, v. granulata, Jones; " " v. nuda; " " v. antiquata; " " v. intermedia; " " v. subtorosa?, J. & H.; " " v. torosa; " " v. tuberculata, Salter; " " J. & H.; " concinna, Jones & Holl; " Maccoyiana; " admixta?; " lacunata; Bollia bicollina; " uniflexa; " Vinei; " " v. nuda; " auricularis, Jones; " interrupta; Kloedenia intermedia, J. & H.; " " v. marginata; Strepula concentrica, J. & H.; " irregularis; " beyrichiodes; Placentula excavata; Primitia lenticularis; " Roemeriana; " fabulina; " variolata; " paucipunctata; " humilis; " valida; " " v. breviata; " " v. angustata; " tersa; " umbilicata; " cristata; " ornata; " cornuta; " aequalis; " diversa; " seminulum, Jones; " furcata, J. & H.; " obliquipunctata, Jones; Ellipsura corpulenta, J. & H.; " tuberosa; " angulata, Jones; " plicata; " " v. unipunctata; " " v. bipunctata; " " v. scripta, J. & H.; Octonaria octoformis, Jones; " " v. intorta; " " v. simplex; " " v. inflata; " " v. bipartita; " " v. persona; " " v. monticulata?; " undosa; " paradoxa; Moorea Smithii; Xestoleberis corbuloides, J. & H.; Aechmina cuspidata, Jones; " bovina; " depressicornis; " brevicornis; Macrocypris Vinei; " elegans; " siliquoides; " symmetrica; " alta; " crassula; Pontocypris Mawii; " " v. gibbera; " Smithii; Bythocypris Hollii; " reniformis; " phaseoloides?; " testacella; " symmetrica; " concinna; " ovata?; " caudalis?; " acuta; " phaseolus; Bythocypris Phillipsiana; " " v. nana?; " pustulosa; Cythere Hollii; " Vinei; " subquadrata; Cythere(lla) Smithii.

| No. | Locality | No. of species from each locality |
|---|---|---|
| 1 | Walsal (Blue Holes) | 9 |
| 2 | Dudley Tunnel | 6 |
| 3 | Dudley Castle | 18 |
| 4 | Wren's Nest | 25 |
| 5 | Sedgely (Wenlock shale) | 18 |
| 6 | " (Aymestry shale) | 2 |
| 7 | Lincoln Hill | 34 |
| 8 | Coalbrookdale Ry. | 27 |
| 9 | Ironbridge Ry. | 37 |
| 10 | Benthall Edge | 28 |
| 11 | Wyke (Tickwood) | 15 |
| 12 | Gleedon Hill | 11 |
| 13 | Wenlock Ry. | 24 |
| 14 | Shadwell | 10 |
| 15 | Norris Quarry | 15 |
| 16 | Bradleyfield | 20 |
| 17 | Ridgend (Woolhope) | 6 |
| 18 | Woolhope | 35 |
| 19 | Lea Wood (Fownhope) | 20 |
| 20 | Common Hill " | 22 |
| 21 | Dormington | 34 |
| 22 | Chuckley Common | 14 |
| 23 | Malvern Tunnel (Blue shale) | 20 |
| 24 | " " (Red shale) | 13 |
| 25 | Ledbury (near Town) | 6 |
| 26 | " (Dog Hill) | 29 |
| 27 | " (Eniker) | 9 |
| 28 | " (Coneygree) | 13 |
| 29 | Presthope (near Station) | 15 |
| 30 | " (1 mile S.W. of " ) | 7 |
| 31 | Rock (Mayhill) | 16 |
| 32 | Longhope | 22 |
| 33 | Eskam Engham | 21 |
| 34 | Prisscoed | 9 |
| 35 | Glasscoed | 6 |
| 36 | Stock Say (Wenlock shale) | 12 |
| 37 | Herefordshire Beacon | 4 |

[illegible]

No. of localities for each species: 6 4 1 .. 8 .. 9 2 27 6 1 11 2 5 5 .. 4 .. 1 .. 5 7 2 15 22 2 11 6 9 21 6 4 14 2 8 .. 6 2 3 1 16 1 12 6 2 1 26 9 3 13 .. 3 1 2 .. 3 .. 1 1 4 23 12 7 .. 3 4 12 24 1 25 25 1 9 5 8 2 1 23 6 2 15 11 4 26 .. 3 15 3 2 18

Species found by Mr. Vine but not by me

In Prof. Jones and Dr. Holl's collection

Scandinavian Species

Total species and varieties ... 94
Species of *Beyrichia* with big lobe, 5

*Note.*—One species obtained by Dr. Holl, viz., *Beyrichia Jonesii*, Boll, is not included in the above list.

XV.

# *SECOND CONTRIBUTION TO THE TOPOGRAPHICAL BOTANY OF THE WEST OF SCOTLAND.*

BY P. EWING.

[Read 20th December, 1889.]

In laying before you the following New Records of plant-distribution for this year, I may say that the list appears comparatively small, and looks as if the great rush over our hills and glens last year had now come to a sudden stop. This is more apparent, however, than real. The more common plants, which had been overlooked by former recorders, were easily obtained, so that every new record now is worth five of the former. Yet, for many orders of plants, the surrounding Watsonian Vice-Counties—Renfrewshire notably—are practically untouched.

Allow me to express my gratitude to those gentlemen, whose names appear below, for their trouble in assisting me to place this information before you. I would again urge those who have not taken up this work to do so, as they would thus enable valuable information to be made available to those interested in this branch of science, and at the same time derive a great amount of pleasure for themselves.

**Argyle** (Vice-Co. 98), recorded by T. King.

Nasturtium sylvestre, R. Br.
Draba muralis, Linn.
Hypericum perforatum, Linn.
quadratum, Stokes.
Rubus affinis, W. and N.
Kœhleri, Weihe.
Senecio sylvaticus, Linn.
Arctium minus, Schk.

Stachys ambigua, Sm.
Atriplex Babingtonii, Woods.
Hippophaë rhamnoides, Linn.
Euphorbia Peplus, Linn.

Owing to Mr. King having been unable to send me his plants in time, the majority of his new records were reported by Mr. G. C. Druce; meanwhile I do not deem it advisable to claim priority of collection, although I have the facts to prove it.

**Dumbarton** (Vice-Co. 99), recorded by L. Watt.

Ranunculus peltatus, Schrank.
Hypericum hirsutum, Linn.
Orobus tuberosus, Linn.
Sedum Telephium, Linn., var. Fabaria, Koch.
Lamium album, Linn.
Potamogeton natans, Linn.
Cryptogramme crispa, R. Br.

**Cantyre** (Vice-Co. 101), recorded by P. Ewing.

Nymphæa alba, Linn.
Drosera anglica, Huds.
Galium Mollugo, Linn.
Arctium intermedium, Lange.
Hieracium vulgatum, Fr.
Ajuga reptans, Linn.
Littorella lacustris, Linn.
Allium ursinum, Linn.
Betula glutinosa, Fr., var. pubescens, Wallr.
Sparganium affine, Schnizl.
Potamogeton natans, Linn.
Carex pauciflora, Lightf.
limosa, Linn.
curta, Good.
pilulifera, Linn.
flava, Linn., var. minor, Towns.
Œderi, Auct.
distans, Linn.
filiformis, Linn.
Elymus arenarius, Linn.
Hymenophyllum unilaterale, Bory.

XVI

# *THIRD CONTRIBUTION TO THE TOPOGRAPHICAL BOTANY OF THE WEST OF SCOTLAND.*

BY P. EWING.

[Read 29th April, 1890.]

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I DO not feel called upon to occupy your time by making any detailed statement regarding this list of New Records. Anyone interested in the subject can, by comparing the three lists, readily find out for himself the orders of plants most neglected by collectors. For this neglect of the more critical genera there is some excuse, as a collector would require to devote himself for a season or two to their special study, and give up general botanical work with the view of overcoming the difficulties which beset their investigation. Who, for example, can be said to know anything of the Batrachian *Ranunculi* of the West of Scotland? This is simply because one would require to carry with him a drying portfolio, in order that the specimens might be washed and floated on to sheets of paper on the spot.

In regard to the *Hieracia*, particular attention should be paid to the flowers when in a fresh condition; and the chief points to be carefully noted are the state of the ligules (whether hairy, pubescent, or glabrous), and the colour of the styles.

The *Rubi* grow so much intermixed that there is a great chance of more than one variety being found

growing together. It is therefore necessary to make sure that in every case the shoots selected are taken from one plant. A flowering shoot should be cut off so as to show a portion of the main stem with at least one leaf attached; then a part of a sucker, or barren shoot, with two or three leaves on it. The plant should be carefully examined to see if the portions taken are sufficient to show all its peculiarities; if not, some additional parts should be secured. All the cuttings from each plant should be numbered, and any peculiarites of the plant itself noted, so that satisfactory answers may be given to any questions which may be put by a specialist.

As for Roses, they must have the fruit well formed; flowers are practically of no use for purposes of identification. If flowers are wished for the herbarium, the bush from which they are taken should be marked, and specimens in good fruit secured from it later in the season.

Mints, Grasses, Sedges, and Charas are but little known.

As I am in constant correspondence with specialists, I shall be glad to obtain an opinion on any critical plants which may be submitted to me.

**Renfrew** (Vice-County 76).—KING.

Rosa scabriuscula (Sm.).
verticillacantha (Mérat).
Juncus tenuis, Willd. For particulars see *Transactions*, vol. iii., p. 166.

**Lanark** (Vice-Co. 77).

Sisymbrium Sophia, Linn.—EWING.
Rosa dumalis (Bechst.).—EWING.
Mimulus luteus, Linn.—M'KAY.
Selaginella selaginoides, Gray.—M'KAY.

**Dumbarton** (Vice-Co. 99).—WATT.

Nuphar intermedium, auct. angl.
Nasturtium sylvestre, R. Br.

Hesperis matronalis, Linn.
Sisymbrium Sophia, Linn.
Cochlearia alpina (Wats.) Bab.
Iberis amara, Linn.
Hypericum perforatum, Linn.—EWING.
hirsutum, Linn.
Sagina maritima, Don.
Lathyrus macrorrhizus, Wimm.
Spiræa salicifolia, Linn.
Rubus Kœhleri, Weihe, var. pallidus, Bab.
Rosa mollis, Sm.
Saxifraga oppositifolia, Linn.
Ribes rubrum, Linn.
Cornus sanguinea, Linn.
Arctium intermedium, Lange.
Hieracium murorum, Linn. pt.
maculatum, auct.
Eupatorium, Griesb.
auratum, Fries.
Leontodon hispidus, Linn.
Taraxacum palustre (DC.).
Lysimachia Nummularia, Linn.
Symphytum tuberosum, Linn.—EWING.
Verbascum Thapsus, Linn.
Pedicularis palustris, Linn.—EWING.
Oxyria digyna, Hill.
Castanea sativa, Mill.
Salix purpurea, Linn.
herbacea, Linn.
Neottia Nidus-avis, Rich.
Tofieldia palustris, Huds.
Juncus filiformis, Linn.
Sparganium simplex, Huds.
minimum, Fr.
Potamogeton pectinatus, Linn.
Eleocharis multicaulis, Sm.
Carex atrata, Linn.
rigida, Good.
stricta, Good.—EWING.
Melica nutans, Linn.

Lycopodium alpinum, Linn.
Selaginella selaginoides, Gray.
Nitella flexilis, Agardh.

**Bute** (Vice-Co. 100).—King.

Hypericum calycinum, Linn.
Acer Pseudo-platanus, Linn.
campestre, Linn.
Trifolium hybridum, Linn.
Rosa dumalis (Bechst.).
dumetorum (Thuill.).
Pyrus Aria, Sm.
Hippuris vulgaris, Linn.
Epilobium angustifolium, Linn.
hirsutum, Linn.
Arctium minus, Schk.
Linaria Cymbalaria, Mill.
Mimulus luteus, Linn.
Polygonum Bistorta, Linn.
Carpinus Betulus, Linn.
Salix argentea (Sm.).
Elodea canadensis, Mich.
Agropyron junceum, Beauv.

**Islay and Jura** (Vice-Co. 102).—Ewing.

Stellaria Holostea, Linn.
Hypericum Elodes, Huds.
Melilotus officinalis, Desr.
Rubus affinis, W. & N.
villicaulis, Kœhl.
macrophyllus, W. & N.
Alchemilla alpina, Linn.
Rosa rubiginosa, Linn.—Growing in perhaps the most natural station where it has ever been discovered.
dumalis (Bechst.).
Saxifraga stellaris, Linn.
Hieracium vulgatum, Fr.
sparsifolium, Lindb.
Lobelia Dortmanna, Linn.
Vaccinium Vitis-Idæa, Linn.

Pyrola minor, Sw.
Veronica scutellata, Linn.
Scutellaria minor, Linn.
Suæda maritima, Dum.
Salix herbacea, Linn.
Populus tremula, Linn.
Potamogeton rufescens, Schrad.
Eleocharis multicaulis, Sm.
Scirpus fluitans, Linn.
Carex flava, Linn.
Œderi, Ehrh.

**Mull** (Vice-Co. 103).—KIDSTON.

Polygala vulgaris, Linn.
Chara fragilis, Desv.

XVII.

# *ON* JUNCUS TENUIS, *WILLDENOW, AS A SCOTTISH PLANT.*

BY PETER EWING.

[Read 29th October, 1889.]

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## **Juncus tenuis**, Willdenow.

**Syn.**—*Juncus gracilis*, E.B.; *J. Gesneri*, Sm., E. Fl.; *J. Smithii*, Kunth.

In the *Scottish Naturalist*, vol. i. New Series (1883-84), p. 264, Mr. G. C. Druce, F.L.S., Oxford, when writing of "The Botanical work of George Don, Forfar," shows very clearly the opinions of authorities regarding Don's record of this plant; and although these may be somewhat lengthy, I notice them in detail so that some idea may be formed of the value of the discovery of this plant in our Clydesdale district.

"One of Don's reputed discoveries."—*Stud. Flora.*

"We have specimens from Don's garden, but we doubt much if the roots were ever found in Clova.—Arnott's *Br. Fl.*

"Prov. 15. Scot.; Dickson. Clova mts., G. Don.

"Ambiguity, Cyb. iii., 47. Neither authority is reliable, but the figure of *gracilis*, in *Eng. Fl.*, vol. 31, No. 2174, may pass well enough for *tenuis*."—*Comp. Cyb. Br.*, 586.

"Said to have been found in a rivulet in marshy ground among the mountains of Clova."—Boswell, *Eng. Bot.*

"Found by G. Don in 1795 or 1796 by the side of rivulet in marshy ground among the mountains of Angus-shire, but very rarely. It appears to be a

nondescript, but we received from Mr. Dickson, some years before the above date, a specimen, not so far advanced towards maturity, of what seems to us the same species."—*Eng. Fl.*, 31, 2174.

"By a rivulet in marshy ground among the mts. of Clova, near their summits. Mr. G. Don and Mr. D. Don (Hb.F.)."—Gardiner's *Flora Forfar*, 183.

"Such a record as Don's is worthless in science until confirmed by some more accurate botanist of the present time."—*Cyb. Brit.*

"A mistake."—*Bot. Man.*, 364.

"In Don's collection of grasses, etc., is a specimen of this labelled 'Clova.' I consider it is *tenuis*, and see no reason why it should not again be found in some of the lower glens of the Clova districts. Miss Palmer has also a specimen of it.

"Nyman gives Gall. occ. Belg. Batav. Germ. (plur. sed sporad.), Bohem."—Druce, *l.c.*, p. 264.

These are the remarks that were passed because Don said he had discovered this plant.

In August, 1863, Mr. John Thomson, Farmer, Dennistoun, Kilmalcolm, sent a specimen to the Greenock Museum, under the name of *Juncus acutiflorus*, and this I will endeavour to certify shortly.

The next time the plant makes its appearance is in 1883, when Mr. R. F. Towndrow discovered it in Herefordshire, in a rough, rather rushy pasture in the Parish of Cradley.

In August, 1886, one of our Corresponding Members, Mr. James M'Andrew, New Galloway, sent a specimen from Kirkcudbrightshire to Mr. Arthur Bennett, F.L.S., Croydon. In Mr. Bennett's remarks in the *Scottish Naturalist* upon this discovery, his great carefulness seems to have prevented him from giving the weight of his opinion as to the plant being a British species; but Mr. M'Andrew, in writing to the *Journal of Botany*, seems to have had no doubt as to its nativity. He says: "It grows on the roadside about three-quarters of a mile

west of New Galloway, near a house, along with *Juncus squarrosus*, *J. lamprocarpus*, grasses, etc. . . . and one cannot see how it could have come there." Dr. F. Buchanan White, F.L.S., when asked for his opinion by Mr. Bennett, replied: "It is not a species (looking at the distribution in Nyman) that I should have expected there." Mr. Bennett remarks, however, that it is a very sporadic plant, and of this we have additional evidence in its discovery in the West of Ireland in August last.

In the *Journal of Botany*, vol. xxvii. (1889), p. 335, Mr. Reginald W. Scully, F.L.S., announces the discovery of this plant in several places in County Kerry. He first noticed it growing abundantly on an old grass-grown road which runs from Sneem to Caherdaniel, and afterwards found it again on a small grassy flat, within a few yards of the sea, as well as at the head of a small bay, on the shore-line between Blackwater Bridge and Kenmare. He remarks that it seems a lover of roadsides, and that its distribution is apparently very erratic.

I have already stated that a specimen of this plant from Renfrewshire was sent, in 1863, to the Greenock Museum, under the name of *J. acutiflorus*, by Mr. John Thomson, Dennistoun. One day last August, while Mr. Thomson, and Messrs. Thomas King and William Stewart, Glasgow, were passing along the road between Bridge of Weir and Kilmalcolm, Mr. King noticed on the roadside a *Juncus* which appeared unfamiliar to him. Specimens were collected by him and afterwards shown to a number of local botanists who were unable to determine the plant, and all expressed the opinion that it could not be referred to any species of *Juncus* recorded for the Clydesdale district. On comparing the plant with specimens of *J. tenuis* collected in Kirkcudbrightshire by Mr. M'Andrew, I became convinced that both were of the same species, and this opinion has been confirmed by Mr. Bennett. A few days ago Mr. King and I, accompanied by Mr.

Thomson, visited the spot and found that the plant grows in more or less abundance for a distance of several hundred yards along the roadside, at a place where the soil is rather sandy.

In comparing the various records to which I have referred, one is immediately impressed by the similarity of the situations in which the plant has been discovered. Thin grassy places, and roadsides at a low elevation, seem to be the spots which it favours, and not marshy places among mountain rivulets, as was formerly supposed.

Is it not at least possible that Don may really have picked up *J. tenuis* by some roadside, in the course of one of his extended botanical wanderings, and that the plant may have got mixed up with gatherings from Clova? In this way, what has hitherto been regarded as a misnomer or error of judgment may after all have been due to a lapse of memory or mistake as to locality.

XVIII.

# *ON THE LAND AND FRESH-WATER MOLLUSCA OF BUTE.*

BY THOMAS SCOTT, F.L.S., NATURALIST TO THE FISHERY BOARD FOR SCOTLAND.

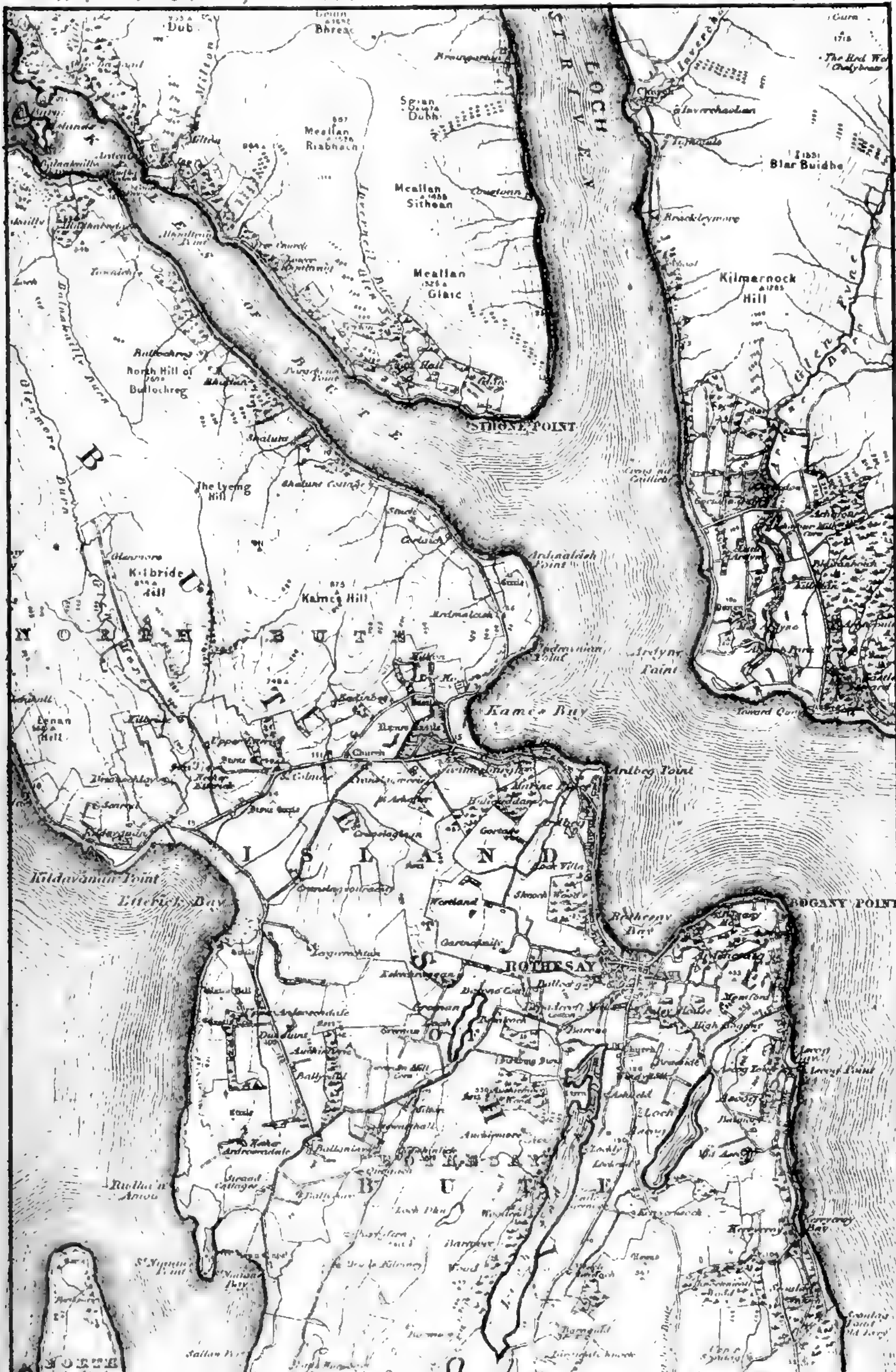
*With Map* [*Plate II.*].

[Read 25th March, 1890.]

In 1869, Mr. William Haddin published in the *Proceedings* of this Society his paper "On the distribution of the Helicidæ in Bute and in the vicinity of Largs." Since then little further appears to have been done towards working up the molluscan fauna of that interesting island. The references to Bute in the List of the Land and Fresh-water Mollusca in *The Fauna and Flora of the West of Scotland* (1876), p. 40, are made chiefly on the authority of Haddin's records, so that for over twenty years these records have contained the fullest account we possess, and afforded our principal source of information, regarding the Bute Mollusca.

A perusal of Mr. Haddin's paper shows that considerable care was taken in its preparation so that it might be as exhaustive as his opportunities for observation would allow, and it must be acknowledged that his efforts were fairly successful. Unfortunately, however, no attempt appears to have been made by him to work up either the fresh-water species or the Limacidæ; and that is to be regretted, as the fresh-water conditions of the island seem to be very favourable to the existence of aquatic molluscs.

My object, therefore, in preparing these notes is to try to fill up in some measure the gap left by Mr. Haddin, as well as to revise his list of the




ISLAND OF BUTE. (CENTRAL PORTION)
SCALE 3/4 IN. TO MILE.

Helicidæ in as far as it relates to the species observed in Bute, and thus bring together all the information we at present possess concerning the number of species known to occur in the island, and also what we know as to their distribution.

By way of explaining how I am in a position to attempt this work, it may be stated that in October, 1886, the Fishery Board for Scotland requested me to proceed to Rothesay to carry out some investigations at the Royal Aquarium; and I was stationed there till the end of June in the following year, that is, between eight and nine months. During these months a good deal of my leisure time was devoted to the examination of the land and fresh-water invertebrate fauna of the island.

My *modus operandi* was somewhat as follows. During the shorter days the locality in the vicinity of the Aquarium was examined, and here a few interesting "finds" were secured, including the rare *Limax (Amalia) gagates.* One or two visits were also made to Loch Ascog and Loch Fad, but comparatively little was done throughout the winter. As soon, however, as the longer days of spring and early summer arrived, I frequently visited, in the early morning and also in the evening, localities more distant than those I had been able to reach during the winter months. Two or three times every week, when the weather was favourable, I was in the habit of leaving Rothesay between 3 and 4 a.m., or sometimes earlier, and proceeding to some place previously fixed on, where I would spend a short time collecting material and taking notes, after which I returned so as to reach the Aquarium before 9 a.m. In this way I have visited Loch Ascog, Loch Fad, Greenan Loch, Ettrick Bay, St. Ninian's Bay, Kames Bay, and other places. A good deal of time was thus also devoted to the examination of the shores as well as the landward part of the island, and that without interfering in any way with the Board's work. These early morning

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rambles were never lacking in interest, and I now look back on these hours, "snatched from sleep" that they might be given to the study of natural history, as the pleasantest and happiest I spent in Bute.

It was my intention to have explored the whole island, but the shortness of my stay prevented this being done. All that I was able in some measure to overtake was the examination of the central and perhaps the more interesting portion of it, which may be roughly defined as bounded by Kames Bay and Ettrick Bay on the north, and Kerrykroy and St. Ninian's Bay on the south. It will be observed that within this area are included the principal lochs of the island, and judging from its physical conditions in other respects, it might reasonably be expected to yield as great a variety of forms of molluscan life as either of the parts to the north or the south of it.

In referring to the distribution of the Mollusca within this area, it may be well first of all to note some of the species observed in the vicinity of the

## Royal Aquarium.

As already remarked, the lateness of the season when I came to Rothesay caused me at first to confine my researches to the neighbourhood of the Aquarium, but the advent of longer daylight did not prevent me from still taking an occasional look around its vicinity. Among the species observed here were *Limax* (*Amalia*) *gagates*, *L.* (*Amalia*) *marginatus*, *Helix aspersa* var. *depressa*, *H. arbustorum* type and var. *marmorata*, besides a number of more common forms.

During the spring and early summer months, on the glass sides of the fresh-water tank in which a number of large pike were kept there might frequently be seen considerable numbers of *Planorbis nautileus* creeping about, as well as small individuals of *Limnæa*; while in another tank, in which were a number of perch and roach, not a mollusc was to

be seen, although all the fresh-water tanks were supplied from the same source, viz., Loch Ascog. It would thus appear that the pike were inclined to look after larger "game" than tiny molluscs. It may be asked: How did the *Planorbis* and *Limnæa* get into the tanks? The reason is simple enough; the water from Loch Fad was not filtered, and consequently numbers of Mollusca as well as Entomostraca were occasionally brought down along with the water into the tanks.

## Loch Fad.

This loch is artificially divided into two parts by an embankment formed across it opposite the farm of Lochly. A road is carried along the top of the embankment, which is very convenient for persons wishing to cross to the other side. The part next to Rothesay is called the "Kirk Dam," and the other is known as Loch Fad proper. The extreme length of the loch, including both parts, is about 2½ miles; while the breadth, which is somewhat variable, is barely a quarter of a mile at the embankment.

Loch Fad occupies part of a natural hollow or valley stretching in a north-easterly and south-westerly direction. The south-east side of the loch is formed of carboniferous rocks—sandstone, shale, and trap;—the north-west side is of grey schistose rocks, passing in some places into blue slate. Along the south-east side, from the embankment south-westward, I found a considerable number of Helicidæ—20 species at least—including 4 species of *Vertigo.* As a matter of fact, I found here a greater variety of Mollusca than in any of the other places examined. I did not find the north-west shore so productive, but one reason for this might be that that side was not examined so thoroughly as the other. I feel assured, however, that the chief reason was the absence of molluscan species, due perhaps to unsuitability of habitat. The finding of so many

species by the shores of Loch Fad is the more interesting, seeing that Haddin, as he states in his paper, failed to observe any Helicidæ at all along these shores. After referring to the distribution of several of the Helicidæ, he says: "It will be observed from the preceding remarks that I have not been able to record a single species from the banks of Loch Fad, while on the shores of Loch Ascog and Loch Greenan are found *Zonites nitidus*," etc. He then goes on to say: "The reason of this I would not venture to affirm, but it is a fact worthy of note that the banks of the former are formed of shale, while those of the latter are of sand." I am quite at a loss to understand how it happened that Haddin failed to observe any Helicidæ on the shores or banks of Loch Fad, though his misapprehending their geological conditions might be more easily explained. The only plausible reason I can offer is that he had examined the shores of Loch Fad at a time when the weather was hot and dry, and when, as might be expected, few if any molluscs would be seen, whereas the very different results obtained by me were owing to the examination having been made in the morning while the air was cool and moist. As has been stated, a good number of species were observed, but they were nearly all of the commoner kinds—*Vertigo substriata*, *V. antivertigo*, and *V. edentula* being the only ones that could be considered uncommon or rare. As regards Loch Fad itself, although I got a boat and dredged a part of the loch, only the common aquatic forms were observed, as will be seen by referring to the list at the end of this paper.

Before leaving Loch Fad, it may be stated that in a little patch of marshy ground on the south-east side, and about a quarter of a mile south-west from the embankment, an Ostracode was observed which had been known previously only as a Post-tertiary fossil under the name of *Cypris browniana*, Jones. The examination of living specimens from this

place showed that it belonged to a genus not previously described. The species is figured and described by Brady and Norman in their recently published Monograph.

Loch Fad can easily be reached by the Barone Road, or by the inland road to Kilchattan Bay. The near end of the Kirk Dam is about three-quarters of a mile from Rothesay, and the embankment fully $1\frac{1}{2}$ mile by either road.

## Loch Ascog.

This loch is much smaller than Loch Fad, from which it is about half a mile distant at its south-west end. It is about a mile long, and scarcely a quarter of a mile broad at the widest part. The shore of the upper or south-west end is of fine sand, and well known to local botanists as the habitat of a few interesting aquatic phanerogams, such as *Lobelia Dortmanna.* A large portion of the shore-line on both sides towards the north-east end is trap-rock, or stones and rough gravel. I did not observe many molluscs about or in this loch; and the only forms worthy of special notice are *Planorbis nautileus* (type and var. *albus*), *Zonites excavatus*, and *Vertigo antivertigo.*

This loch can easily be reached by the inland road to Kilchattan Bay, or by the road passing Folly House and Braeside.

## Loch Greenan,

or Greenan Loch, as it is called by the people in the district, is quite a small sheet of water, being only about half a mile in length and scarcely two hundred yards wide. It is situated about one mile north-west of the Kirk Dam, and is easily reached by the Barone and St. Ninians Bay Road.

During summer the lower or south-west end is overgrown with vegetation. There are white and yellow water-lilies (*Nymphœa alba* and *Nuphar luteum*) growing in abundance, on the stems and

leaves of which may be found the curious polyzoon *Cristatella mucedo*, and the equally interesting and pretty entomostracan *Sida crystallina*. Here *Hydra vulgaris* also luxuriates, and many other strange-looking organisms. This end is so shallow, and dries up so much, that in some places it may be crossed on foot. There is so much decaying vegetation that the water, as it becomes warmed with the summer's sun, is found to be literally teeming with minute forms of life, and no doubt forms a "happy hunting-ground" for the micro-zoologist who may happen to find his way to the spot.

I found comparatively few terrestrial molluscs about this loch; and although aquatic forms were numerous enough, those observed belonged to common species, with the exception of *Planorbis glaber*, Jeffreys (*P. parvus*, Say), which occurred at the lower end of the loch, and was not unfrequent.

### Kames Bay District.

The promontory on the opposite side of the bay from Port Bannatyne is known as Undranian Point, and there are here what appear to be the ruins of a limekiln. Under the loose stones which lie scattered about were observed *Helix pulchella*, *H. pygmæa*, *Zonites radiatula*, and several common species. By the side of a wall a short distance north from the Hydropathic Establishment, and at the side of an old inland road which joins the road to Ettrick Bay, a short distance to the west of the head of Kames Bay, were found *Helix aspersa* var. *conoidea* and *H. hispida* var. *alba*; while, by the side of a small rivulet above Skeoch Wood, *Zonites nitidus* was of somewhat frequent occurrence.

### Ettrick Bay District.

The species observed here were chiefly common ones, the only forms calling for special notice being *Helix caperata*, *H. pulchella*, and a very small variety of *Clausilia rugosa*. Haddin records finding one

specimen of *Helix rufescens* at Ettrick Bay, but I did not observe this mollusc here or elsewhere within the area examined.

When at Ettrick Bay I had a hunt round for the Horned Poppy (*Glaucium luteum*) which used to grow by the side of a little burn that runs into the bay, but failed to find it. I hope that it has not become extinct.

### St. Ninians District.

*Helix ericetorum*, which Haddin recorded as having been observed here, still exists, but apparently is not very common. With this exception, all the molluscs observed about St. Ninians Bay were common species.

### Ascog and Kerrykroy District.

The only place where I observed *Planorbis spirorbis* was in a pond above Ascog Bay; and in the wood by the shore, near the entrance to the old coal-mine, I got the curious little *Helix aculeata*, as well as *Vertigo edentula*. Some of the commoner molluscs, such as *Pupa umbilicata*, were plentiful in this district. Haddin records finding *Pupa ringens* in Mountstuart Wood; but I did not observe this species in any of the localities examined, and have included it in the list on his authority.

I have now made a general though hasty reference to the more or less noteworthy molluscs found within the area described. A full list follows of all the species known to occur in Bute, including those recorded by Haddin but which I failed to observe. A map is appended of the portion of Bute specially referred to in this paper.

## List of Species, including also some Varieties, of Mollusca observed in the Island of Bute.

The arrangement and nomenclature of Jeffreys' *British Conchology* are followed.

### Conchifera.

#### Sphæriidæ.

isidium, . Pfeiffer.

*Pisidium fontinale* (Drapernaud).—Loch Fad; frequent.
,, *pusillum* (Gmelin).—Loch Fad, Loch Ascog, and other places.
,, *nitidum*, Jenyns.—Loch Fad; frequent.

### Gasteropoda.

#### Limnæidæ.

lanorbis, uettard.

*Planorbis nautileus* (Linné).—Loch Ascog, Greenan Loch.
,, ,, var. *alba*, mihi.—Loch Ascog; rare.
,, *albus*, Müller.—Loch Fad, Greenan Loch.
,, *glaber*, Jeffreys (*P. parvus* Say).—Greenan Loch.
,, *spirorbis*, Müller.—Small loch or pond near Ascog.
,, *contortus* (Linné).—Loch Fad, Greenan Loch.

hysa, amarck.

*Physa fontinalis* (Linné).—Side of Loch Fad.

imnæa, ruguiere.

*Limnæa peregra* (Müller).—Common in ditches and lochs.
,, *palustris* (Müller).—Marshy ground at the west end of Greenan Loch.
,, *truncatula* (Müller).—Frequent in ditches and lochs.

ncylus, eoffroy.

*Ancylus fluviatilis*, Müller.—Loch Fad, Loch Ascog.

#### Limacidæ.

rion, erussac.

*Arion ater* (Linné).—Common.

imax, inné.

*Limax gagates*, Drapernaud.—Frequent in a garden near the Aquarium.
,, *marginatus*, Müller.—Not very common in the vicinity of the Aquarium.
,, *agrestis*, Linné.—Common.
,, *arborum*, Bouchard-Chantereaux.—Frequent; vicinity of the Aquarium, near Loch Fad, and on beech trees west of Rothesay.
,, *maximus*, Linné.—Vicinity of the Aquarium, among herbage on the shore at Ettrick Bay, and other places.
,, *lævis*, Müller.—Frequent in damp situations under stones; shore of Loch Fad, and other places.

## HELICIDÆ.

*Succinea putris* (Linné).—Loch Fad. (St. Ninians Bay.*)

*Vitrina pellucida*, Müller.—Shores of Loch Fad.

*Zonites cellarius* (Müller).—Common; shores of Loch Fad, and other places.

,, *alliarius* (Müller).—Common; shores of Loch Fad, and other places.

,, *alliarius* var. *viridula*, Jeffreys.—Shore of Loch Fad; not common.

,, *nitidulus* (Drapernaud).—Frequent; shores of Loch Fad, and other places. (Woodend.*)

,, *radiatulus* (Alder).—Shores of Loch Fad. (Chapelton.*)

,, *purus* (Alder).—Shores of Loch Fad; not very common.

,, *nitidus* (Müller).—Shores of Loch Fad. (Loch Ascog,* Greenan Loch.*)

,, *excavatus* (Bean).—Shores of Loch Fad and Loch Ascog. (Near Chapelton,* above Ardbeg Point.*)

,, *crystallinus* (Müller).—Common; shores of Loch Fad, and other places.

,, *fulvus* (Müller).—Frequent; shores of Loch Fad, and other places.

*Helix lamellata*, Jeffreys.—(Woodend,* Mountstuart.*) I did not observe this species.

,, *aculeata*, Müller.—(Woodend,* Mountstuart.*) Wood by the side of the shore road near Ascog.

,, *aspersa*, Müller.—Common; shores of Loch Fad, and other places.

,, *aspersa* var. *conoidea*, Picard.—By the side of an old wall at Port Bannatyne.

,, *aspersa* var. *depressa*, Scott.—In the vicinity of the Aquarium.

,, *nemoralis*, Linné, including several colour-varieties.—Common; shores of Loch Fad, and other places.

,, *arbustorum*, Linné.—Common in the vicinity of the Aquarium. (Woods behind Kamesburgh.*)

,, *arbustorum* var. *marmorata*, Taylor.—In the vicinity of the Aquarium.

,, *rufescens*, Pennant.—(Ettrick Bay, one specimen.*)

,, ? *concinna*, Jeffreys.—In the vicinity of the Aquarium. Specimens were sent to Mr. Taylor, Leeds, and while he agreed with me as to their identity with *H. concinna*, Jeffreys, he stated that he did not consider the species a very satisfactory one. It certainly comes very near *H. hispida*, and considerable famili-

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On Haddin's authority. See his paper in *Proc. Nat. Hist. Soc., Glasg.*, 1869.

arity with this form is required to be able to distinguish it from some varieties of *H. hispida.* With some doubt, therefore, as to its being distinct from the latter species, it is included in my list.

*Helix hispida,* Linné.—Frequent; shores of Loch Fad, Port Bannatyne, and other places.

,, *hispida* var. *albida,* Jeffreys.—By the side of a wall near the Hydropathic Establishment, Port Bannatyne.

,, *fusca,* Montague.—Shores of Loch Fad. (Mountstuart,* Ardbeg.*)

,, *caperata,* Montague.—By the shore at Ettrick and St. Ninians Bays. (Banks of Greenan Loch.*)

,, *ericetorum,* Müller.—St. Ninians Bay,* where I also observed it.

,, *rotundata,* Müller.—Common everywhere; Loch Fad, etc.

,, *pygmæa,* Drapernaud.—Near Ardmalish Point, Kames Bay; rare.

,, *pulchella,* Müller.—Near Ardmalish Point, Ettrick Bay. (St. Ninians Bay.*)

**ıpa, ımarck.** *Pupa ringens,* Jeffreys.—(Mountstuart Woods.*) I did not observe this species.

,, *umbilicata,* Drapernaud.—Common; shores of Loch Fad, etc.

**ertigo, üller.** *Vertigo antivertigo* (Drapernaud).—By the shores of Loch Fad; frequent. Loch Ascog; not common. (Greenan Loch.*)

,, *pygmæa* (Drapernaud).—By the shores of Loch Fad; frequent. (Loch Ascog.*)

,, *substriata,* Jeffreys.—By the shores of Loch Fad; rather scarce.

,, *edentula* (Drapernaud).—By the shores of Loch Fad, in a wood at Ascog. (Side of Greenan Loch,* Skeoch Wood.*)

**alia, rideaux.** *Balia perversa* (Linné).—On trees near the side of Loch Fad, on trees near the old church west of Rothesay, St. Ninians Bay,* and other places.

**lausilia, rapernaud.** *Clausilia rugosa,* Drapernaud.—Common; in the vicinity of the Aquarium, and other places.

,, *rugosa,* small var.—By the side of an old wall at Ettrick Bay.

**ochlicopa, 'erussac.** *Cochlicopa lubrica* (Müller).—Frequent; shores of Loch Fad, and generally throughout the district.

CARYCHIIDÆ.

**arychium, lüller.** *Carychium minimum* (Müller).—Commonly met with throughout the district, in moist places; shores of Loch Fad, etc.

A perusal of the foregoing List will, I think, show that there is every likelihood of further research being rewarded by the discovery of other additions to the Mollusca of the island. Thus several aquatic species — such as *Sphærium corneum*, *S. lacustre*, *Valvata piscinalis*, *V. cristata*, *Planorbis nitida*, etc. —may yet be found to occur in one or other of the lochs or ditches. The Swan Mussel (*Anodonta cygnæa*) may also yet be discovered in some of the lochs, as the conditions seem to be as favourable for its existence—say, in Greenan Loch—as they are in Lochend Loch, Edinburgh, where it is moderately common.

It may be noted here in passing, that *Planorbis complanatus*, which Haddin, when he read his paper on the Bute Helicidæ in 1869, recorded from Lochend Loch as being an addition to the Scottish Fauna, was previously known for more than thirty years to be a common species in that Loch. The second edition of *Excursions illustrative of the Geology and Natural History of the Environs of Edinburgh*, by William Rhind, M.R.C.S., etc., published in Edinburgh and London in 1836, contains a list of the local Land and Fresh-water Mollusca, which includes the species referred to, with the remark "Common; Lochend." It was thus recognised as a Scottish species long prior to Haddin's record.

Though, as has been pointed out, several aquatic molluscs may yet be added to the fauna of Bute few additions to the terrestrial species now recorded are likely to be met with in the island. The following, however, may yet be observed: *Arion hortensis*, *Limax flavus*, *Succinea elegans*, *Helix rupestris*, *Pupa marginata*, *Bulimus obscurus*, and *Acme lineata*.

Sixty-one species and varieties are recorded in the preceding list, and these, with one or two exceptions, have all been certified by Mr. John W. Taylor, F.L.S., Leeds.

XIX.

# *NOTES ON THE RARER PLANTS OF THE PARISH OF OLD KILPATRICK.*

BY L. WATT.

[Read 25th March, 1890.]

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In the *Clydesdale Flora* of Professor Hennedy, numerous localities are given for plants which grow in the neighbourhood of Glasgow, but these include comparatively few in the parish of Old Kilpatrick. The number is considerably increased, however, in the *Fauna and Flora of the West of Scotland*, published in 1876.

That the records of the rarer plants of the parish are so few is scarcely, perhaps, to be wondered at when the nature of the ground is taken into account. The Kilpatrick Hills, which lie on the north side of the River Clyde, and rise to a considerable altitude, are composed of basaltic-trap rock, and are intersected by numerous streams, which in some cases flow through deep gorges, forming glens of no small beauty. These streams, in their rapid descent to the lower ground, flow over successive falls of greater or less height before reaching the waters of the Clyde, Endrick, and Kelvin. The principal local tributaries of these rivers are the Overtoun Burn on the west, the Lusset Burn at Kilpatrick, and Loch Humphrey and Cochno Burns on the east, all which find their way into the Clyde. On the north side are the Crux and Finnich Burns which flow into the Endrick, and the Allander which finds its way into the Kelvin, but these

streams lie beyond the boundaries of the parish of Old Kilpatrick.

An occasional botanist visitor, even although he should refuse to notice the numerous sign-boards warning him of penalties rigorously exacted from the "trespasser," would have some difficulty in knowing where to begin work, especially amid surroundings which in many cases would not seem very promising. Yet the number of plants found in the district is very considerable; and although few of these are perhaps very rare, some of them are certainly not often to be met with in Clydesdale.

As a committee of the British Association is at present investigating the causes which have led to the disappearance of native plants from their habitats, it may not be out of place here to mention that the character of the river-margin between Clydebank and the building at Dalmuir occupied as the works of the Clyde Trustees, a distance of nearly a mile and a half, has, within the last nine years, been completely changed. This extent of river-margin consisted entirely of marshy ground, varying in width from 100 to 400 feet, where the following plants occurred in abundance: *Ranunculus sceleratus*, L., *Cochlearia officinalis*, L., *Lepigonum neglectum*, Kindb., *Alisma Plantago*, L., *Triglochin maritimum*, L., *Scirpus Tabernæmontani*, Gmel., *S. maritimus*, L., *Carex acuta*, L., and *Phragmites communis*, Trin. The marsh itself, with these and other plants, has disappeared, and through the operations of the Clyde Trustees all the waste ground has been reclaimed. While from an agricultural point of view this result is not to be regretted, the botanist can scarcely avoid contemplating with dismay the large inroad made upon his territory. Of *Scirpus Tabernæmontani*, which is very locally distributed along the banks of the Clyde, there were only a few plants to be seen last year on the north side of the river, and these were confined to the immediate vicinity of the Dalmuir Works. This

plant, however, is still plentiful on the opposite side, where it extends along the margin of the old bend of the river from a point nearly opposite Messrs. Thomson's shipbuilding yard at Clydebank to Erskine Ferry. The question whether it will long remain in this station can only be decided by the operations of the Clyde Trustees, and at present they are filling up the margin near the east end of the old bend. Let us hope, however, that a long time will elapse before these plants disappear entirely from the upper reaches of the Clyde.

From the Dalmuir Works westward to Old Kilpatrick most of the ground consists of reclaimed marsh, but with this difference, that for half a mile the river-side has been built up so as to form a broad bank; and as the waste ground from the bank to the border of the fields has been left at the old marsh-level, some of the plants already mentioned still grow there. Onward to Old Kilpatrick the ground is partly under cultivation, but towards Bowling we have again soft marsh varied with grassy tufts, on which the Sea Pink (*Armeria maritima*, Willd.) first makes its appearance, along with *Glyceria maritima*, Wahl. In the vicinity is Hennedy's station for *Scirpus* (*Blysmus*) *rufus*, Wahlb., which, however, is slowly being washed away. Last year I could not see a single plant where formerly I used to find from twelve to twenty. Towards Bowling there is sandy beach; from Bowling to Dunglass Castle, reclaimed land; and from Dunglass to Dumbarton the margin remains in much the same condition as in Hennedy's time, viz., soft marsh with grassy tufts. *Œnanthe Lachenalii*, Gmel., is still plentiful here, as recorded by Hennedy, but apparently does not grow elsewhere in the district.

The following are some of the rarer plants found in the parish of Old Kilpatrick. Except in a few cases, which are specially noticed, no Dumbartonshire localities are given for any of these plants by Hennedy, or in the *Fauna and Flora*. The species

or varieties marked with an asterisk are not recorded for the West of Scotland in either of these works.

*Clematis Vitalba*, L.—In a hedge at Dunglass Castle, Bowling. Although I have seen this plant there for the last ten years, it has not flowered until last summer.

*Thalictrum flavum*, L.—In a dyke between the Forth and Clyde Canal and the river near Kilpatrick.

*Ranunculus fluitans*, Lam.—Formerly found in a small burn between Clydebank and Dalmuir, but now extinct owing to the burn having been used as the conduit for the sewage from the village of Radnor Park. As the burn was subjected to the tidal flow of the river, there can be no doubt that the plant was originally introduced in this way, along with *Potamogeton perfoliatus*, L., which is common in the Clyde.

Hennedy remarks that *R. fluitans* seldom flowers near Glasgow. I watched this plant for three years before obtaining its flowers. There were always plenty of buds below the surface, but few of these seemed to open into bloom. I have observed a similar condition of *R. fluitans* in the River Leven.

* *Ranunculus trichophyllus*, Chaix., var. *demersus*.—Rare. Specimens were shown by Mr. Ewing at a meeting of the Society on 26th November. These were found in the burn which runs between Loch Fyn and Loch Humphrey on the Kilpatrick Hills. This plant has not been observed elsewhere in the county, and is not referred to in any of the Floras.

*Ranunculus Lenormandi*, F. Schultz.—Rare. In a ditch at Low Bog, Kilpatrick Hills.

*Ranunculus auricomus*, L.—Woods at Auchentorlie, Bowling. In reference to the occurrence of this plant at Kenmuir Bank, on the Clyde, a few miles above Glasgow, Mr. R. Turner has remarked: "This appears to be about its most northern limit in the West of Scotland; and the specimens found have usually imperfect petals, a form sometimes known as var. *depauperatus*,

which apparently marks the margin of its area of growth."*

* *Nuphar intermedium*, auct. angl.—Rare. Lily Loch, Kilpatrick Hills. This plant may readily be distinguished from *N. pumilum*, Sm., by its larger size, as well as by the form of the stigma. In *N. intermedium* the stigmatic rays scarcely reach the waved margin of the stigma, while in *N. pumila* the rays extend to the margin, which is distinctly lobed. Not previously recorded for the West of Scotland. The only localities mentioned by Hooker are Northumberland and East Perth.

*Hesperis matronalis*, L.—Alien. This plant, pointed out to me by Mr. Tawse, was growing on the walls of an old cottage at Milton, where it had no doubt been cultivated by a former tenant.

*Silene Cucubalus*, Wibel, var. *puberula*, Syme.—Near the banks of the Clyde, between Dalmuir and Kilpatrick; and on the side of the road to Duntocher.

* *Sagina apetala*, L.—Rare. On rocks at the west end of Bowling. Hennedy remarks: "The *S. apetala* described in the district by Hopkirk and Patrick is *S. subulata*"; and the reason why this plant so long escaped notice may be that it does not remain long in seed, and soon withers away on the dry rocks where it grows.

*Malva moschata*, L.—Not common, although locally abundant on the banks of the Clyde between Dalmuir and Kilpatrick, as well as on Dumbuck, Dunglass, and Dumbarton Rock, which is Hennedy's station.

*Potentilla reptans*, L.—Rare. On the roadside between Dalmuir and Duntocher, where it grows along the hedge-bank, but the long-peduncled flowers soon shed their petals.

*Drosera anglica*, Huds.—In a peat-bog near Edinbarnet, to the right of the sheep-farm on the Kilpatrick Hills. This is the only spot where I

* *Trans. Nat. Hist. Soc. Glasg.*, i. 220.

have seen *D. anglica,* and it is likely soon to disappear as the bog is now being drained.

*Hieracium vulgatum,* Fries, var. *maculatum,* auct. —On the higher rocks, Kilpatrick Hills. Recorded by Hennedy for "Dumbarton," but the exact station is not given.

*Lysimachia thyrsiflora,* L.—In a small ditch on the north side of the canal between Clydebank and Dalmuir, and in an old lade between the canal and the river, but apparently never flowering.

*Lysimachia vulgaris,* L.—A few plants at the mouth of the Dalmuir Burn. Hennedy mentions "Bowling" as a locality for this species, but it has not recently been seen there or elsewhere in the district than at Dalmuir.

*Borago officinalis,* L.—Alien. On the bank at Clydebank Railway Station.

*Pulmonaria officinalis,* L.—Milton Glen, but no doubt as a garden outcast, although it has been established there for years.

*Echium vulgare,* L.—Banks of the Clyde at "Dundonald's Light" between Kilpatrick and Bowling for several successive years, but no doubt an introduction.

*Parietaria officinalis,* L.—This plant still grows on the Hawk Craig, Bowling, where it was first seen in 1878. I have not observed it in any other locality in the district.

*Neottia Nidus-avis,* Rich.—By the side of the Overtoun Burn. Owing, no doubt, to the favourable summer, the flowers were larger this year than any formerly seen.

* *Allium vineale,* L., var. *bulbiferum,* Syme.—Grows freely on Dunglass Castle, Bowling, the station given by Hennedy for *A. vineale.* Last year a specimen was sent to Mr. A. Bennett, F.L.S., and referred by him to var. *bulbiferum.*

* *Luzula albida,* DC.—Alien. Wood at Barnhill, near Overtoun-Milton, where it appears to have been established for a considerable time.

* *Potamogeton pectinatus,* L.—Rare. Forth and Clyde Canal at Bowling.

*Carex dioica,* L.—Boggy ground in various places on the Kilpatrick Hills; above Kilpatrick, and above Hardgate, Duntocher.

*Carex pauciflora,* Lightf.—Plentiful on the moor north-west of Cochno Loch, and at the east end of Loch Humphrey. Hennedy records it for "near Glasgow," but does not indicate the precise locality.

* *Carex disticha,* Huds.—In a ditch between Dalmuir Burn and Kilpatrick, on ground reclaimed from the tidal action of the river. The plant was still there last summer, but will probably disappear when the ditch dries up.

*Carex irrigua,* Hoppe.—This rare sedge is found in nearly all the stagnant pools filled with *Sphagnum* on the Kilpatrick Hills, from Loch Humphrey south-eastward along the centre of the range to its termination, but very sparingly on the north side of the hills. I have never found it in running water, or in the deeper pools where *Sphagnum acutifolium* commonly grows, but always among the more elevated masses of *S. cymbifolium.* These the sedge penetrates with its running roots, and throws up its stems, each bearing three drooping spikelets of female flowers.

*Carex limosa,* L.—Hennedy records this plant for "marshes at Bowling," on the authority of the late Mr. William Gourlie; but if the marshes referred to are those on the hills, *C. irrigua* must undoubtedly have been the plant indicated. I have never seen *C. limosa* about Bowling, either on the low ground or among the hills.

*Melica nutans,* L.—Auchentorlie Woods, Bowling.

*Cryptogramme crispa,* Br.—Rather plentiful on Duncombe, Kilpatrick Hills. Recorded for "Kilpatrick Hills" in the *Fauna and Flora,* but no particular station is indicated.

*Isoetes lacustris,* L.—Two specimens were found in Lily Loch, Kilpatrick Hills, and there can be no

doubt that these had been carried by birds from Loch Lomond. On the sandy shores of Inchcaillioch, facing Balmaha, this plant is very plentiful, along with *Subularia aquatica*, L. Loch Cochno and Lily Loch are both given as stations in the *Fauna and Flora*, but as yet I have only found *Isoetes* in the latter loch.

In conclusion, I have to thank Mr. P. Ewing for getting the doubtful plants identified, and the whole of them certified by Mr. A. Bennett, F.L.S.

XX.

# *JOTTINGS FROM MY NOTE-BOOK.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

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## TUBULARIA HUMILIS, *Allman.*

[Read 29th October, 1889.]

AT the latter end of this season, when in company with Mr. A. Turbene of the Millport Marine Station, we found this beautiful little hydrozoon moderately common on the timbers of Keppel Pier, Millport, and plentiful on the bottom of a boat moored at the same place, also sparingly on some of the numerous boats drawn up on the shore about half a mile distant from the Keppel. Had this species been as plentiful there in former years as it has been this season, I think that I could scarcely have failed to notice it.

Whether it is an accidental introduction brought with the timbers of the new pier, and destined either to thrive and spread over the country (as so many of our introductions have already spread), or dwindle away in the absence of its wonted conditions; or whether it is only one of those visitors that we sometimes see at long intervals, time alone can determine.

Hincks, in his *British Hydroid Zoophytes*, states the habitat of this species to be "on rocks close to the level of low spring tides, near the mouth of Kinsale Harbour (Ireland). G. J. A."

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## LAGIS KORENI, *Malagren.*

[Read 24th December, 1889.]

The tube of this not-uncommon worm, which I had supposed to be *Pectinaria belgica*, Pallas, had often come under my notice while digging in the sand

between tide-mark, as well as when dredging; but not having previously noticed the animal in its natural position, I was under the belief that it burrowed in the sand or mud, with the small end of the tube downward, and with its head and the wide end of the tube at the surface, ready to secure its passing prey. This view of its habits is supported by the late Dr. Johnstone in his *Catalogue of British Non-Parasitic Worms*, p. 243, as well as by the following quotation given by him from Pallas: "When at ease, and covered with the water, it protrudes, from the wide aperture of the tube, the head with its four cirri, the comb of bristles, and its many tentacles. The latter are in continual movement and twisting about at will, in search seemingly for fit grains of sand; and as the grains adhere by a gluten secreted from the surface, they are carried within the reach of other organs, by means of which the worm applies them to the rim of its tube, and thus carries the structure upwards."

Last summer, when at Little Cumbrae, my attention was drawn to one of these tubes, the small end of which was projecting about an inch above the surface of the sand between tide-mark. I was surprised to find the tube in this position; and had only one individual been noticed, it might have been supposed to have got so placed through accident. On further search, however, others were found projecting in the same way, leaving no room for doubt that such was the natural habit of the animal. The small ends of the tubes above the sand were all observed to be much darker in colour than the portion under it, leading to the belief that the worm must spend a considerable part of its time with the small end of the tube above the surface. While we may therefore presume that exposure was the cause of the difference in colour, yet we can scarcely believe that the tube always remains stationary. During storms, the great quantity of seaweed and other materials thrown up by the waves upon the beach would certainly destroy

the projecting points of the tubes; but the worm may be sensitive enough to know of the coming storm, and avoid the danger by going deeper into the sand. With the view of ascertaining if this habit of the animal had been previously observed, I submitted specimens to Professor W. C. M'Intosh, St. Andrews, who replied that the fact had never come under his notice, although he saw nothing inconsistent in the worm going down into the sand head-foremost, when the comb of golden bristles in front would be useful in digging; and that the species I had referred to *Pectinaria belgica*, Pallas, was *Lagis Koreni*, Malagren.

There can be no doubt that the observations by Pallas, above referred to, were made with the animal in confinement, and placed for examination in sand, with the small end of the tube downward, under the belief that such was its natural position. This shows how readily we may be led to adopt erroneous conclusions through preconceived ideas.

Since the above was written, Professor M'Intosh has kindly brought under my notice an article in the *Transactions of the Royal Society of Edinburgh*, Vol. XXXIII., Part III., p. 656, where a correct statement is made as to the animal burrowing in the sand with the narrow end of the tube projecting above the surface.

Last winter, after a storm, I got a few more tubes which had been thrown up on the beach; and as these contained the living animal, I had an opportunity of studying its habits in confinement. When the worm is obtained in its tube in good condition, and laid flat on sand of sufficient depth to allow it to go down as far as necessary, it begins in a short time to burrow obliquely into the sand head-foremost, getting more and more into a vertical position, and generally leaving the narrow end of the tube, to the extent of about half an inch, projecting above the surface. Sometimes they go down till the apex of the tube is level with the sand, and some of the

young specimens went under it altogether. They were seen occasionally ejecting short streams of sand from the projecting tubes, and forming little heaps of sand after the manner of *Arenicola piscatorum*. They sometimes came up out of the sand, and moved horizontally forward with the wide end of the tube foremost; in the course of the night they thus travelled six or seven inches, leaving a rough track on the smooth surface of the sand. Some left the tube, and died shortly afterwards; yet that does not seem to be their constant habit, as they are often found dead within the tube.

The grains of sand are very even on the outside of the tube, while they project more or less on the inside. A smooth surface may be got to face the outside; but there is every chance that the opposite side of the grain may be angular, and hence the rough inside of the wall. The animal, however, has itself well protected from the rough surface by a thick lining-membrane.

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## Habits of a Hedgehog (*Erinaceus europæus*) in Domestication.

[Read 25th March, 1890.]

Many years ago I adopted a hedgehog as a pet, and during the progress of its civilisation I had an opportunity of becoming acquainted with some of its habits. A short time after it came into my possession it had four young ones. After the first day they all unaccountably disappeared. There were neither dogs, cats, nor rats in the house which could be suspected of having taken them. Could the mother have devoured her offspring? I never could solve the mystery.

At first the animal was very shy, and seldom ventured to unfold itself. Any noise caused it to curl up more or less, according to the degree of alarm. It did not seem to see objects at any considerable distance, but a chirp or smart rap on the table

brought it immediately to a stand. If there was no appearance of immediate danger, and a convenient retreat was at hand, it made all possible speed to get under cover; but the moment it was brought face to face with danger, flight was abandoned, and the curled attitude assumed which presented its bristling armature all round. I had a box made for it, full of soft hay, and with an opening for an entrance like that of a dog-house; and the animal soon took to its new quarters. The box was kept in the kitchen; and the hedgehog used to come out at night, after we were in bed, and go back and forward for an hour or two at a time, along the lobby between the kitchen and the parlour—a distance of about fifteen or sixteen feet. We knew when it was afield by hearing its feet pattering on the floor. What was remarkable in this case was that during these night-wanderings it did not seem to be constantly on the hunt, as the footmarks showed that it had kept on the same path, backward and forward, for a long time; and the discoloration made on the track along which it had run showed that something had oozed from its feet as it trod along. From this we may understand how dogs can so well follow the trail of such animals, and that the sense of smell must be very acute to enable the dog to find its master by the odour left in the print of his shoe.

I had often heard it stated that hedgehogs were fond of fruit, and that they were able not only to climb fruit trees in gardens and throw the apples down, but to roll themselves on the fallen fruit until their sharp spines had got covered with apples, which were carried off to their nest. I accordingly tried my pet with apples, but it would not taste them. It fed on sweet milk, but seemed to relish insects most. When it came to a shoe, or any such object on the floor, it tumbled it over and searched beneath with great eagerness, no doubt in hope of finding insects. When a fly chanced to be on the

floor the hedgehog never seemed to see it until it had approached within a distance of about four inches. Quick as the fly is in its movements, I never saw the hedgehog miss one when it had made the bound. I have seen flies within seven or eight inches of the hedgehog's nose, without the animal showing the least appearance of having seen them, which led me to think that it did not see to any great distance. When it got hold of a cockroach, it would eat it up bit by bit, not letting the least morsel drop from its small mouth.

It became less shy by degrees, and finally got so tame as to allow itself to be stroked. When on its feet, with its spines down, it felt quite smooth to the touch. When I happened to fall asleep at the fireside, as I sometimes did in the evening, it would come and take hold of the heel of my stocking; and although I never allowed its teeth to reach the skin, yet it always wakened me when it took hold. On one occasion, when I felt it at my heel, I threw my foot suddenly up; and as the hedgehog's teeth had got caught in the wool of the stocking, it was thrown a considerable distance across the floor.

We had never seen its droppings about the house, and often wondered where they could be disposed of. I had a quantity of fossils and other mineral specimens laid on the floor of a wall-press in a small room not much used except as a store for such objects. One day I went to look at some of my fossils, and, to my disgust, found them covered with filth, and the floor wet below—the stench, when the stones were turned over, being intolerable. Can this be the natural habit of the animal? Dogs and cats can be trained to such habits, but the hedgehog had never been put under any such discipline by me. The whole house was searched for other deposits of a like kind, but none were found. After this discovery, the poor hedgehog, for no fault of her own, had to quit her domestic quarters.

## On some Recent Marine Ostracoda dredged in Granton Harbour.

[Read 28th January, 1890.]

The following List of Ostracoda appears to be unusually full, when we take into account the nature of the locality where they were dredged twenty-one years ago. The place was a small sheltered bight on the west side of the Granton Railway Station, opposite a joiner's workshop, where we hired a small boat which was not very suitable for dredging purposes. The day was windy, and we could not venture outside the harbour in such a boat. As we did not wish to spend time in so unpromising a place, we contented ourselves with one haul of a small seven-inch dredge. It sometimes happens that good results are obtained where least expected, and such was the case with our dredging experiment.

The List contains 47 species, and two or three others were not satisfactorily identified. There are a few fresh and brackish water species, and probably some others, which do not strictly belong to the locality. It is most likely that these organisms are carried by currents into such sheltered places, where they settle down and remain, although the habitat may not be the most favourable for them.

There is a small bay at Roundstone, Ireland, called "Dog's Bay," where Foraminifera, Ostracoda, and small shells are so abundant as to lie in small wreaths on the beach; but that abundance is confined to a very small portion of the bay, not more than a few yards in extent, while the other parts are almost barren. Ostracoda are rather poorly represented in the beach gatherings, but Foraminifera and shells are most abundant. These, being mostly dead, will readily float on the rising tide from the neighbouring shore, and probably be drifted by the wind into that particular part of the bay where they are so abundantly found.

Such cases will account in some measure for the

waifs and wanderers occasionally found amongst our gatherings. An apparent richness in certain places may sometimes be due to accident, and the goodly group from Granton Harbour most likely owes part of its wealth to the same cause.

LIST OF SPECIES.

*Cypria ophthalmica* Jurine (= *Cypris compressa* Baird).
„ *lævis* O. F. Müller.
*Cypridopsis aculeata* Lillj.
*Pontocypris mytiloides* Norman.
„ *trigonella* G. O. Sars.
*Argillæcia cylindrica* G. O. Sars.
*Cythere concinna* Jones.
„ *lutea* Müller (= *viridis* Brady).
„ *antiquata* Baird.
„ *tuberculata* G. O. Sars.
„ *albomaculata* Baird.
„ *villosa* G. O. Sars.
„ *confusa* Brady and Norman (= *pellucida* G. O. Sars).
„ *pellucida* Baird (= *castanea* G. O. Sars).
„ *porcellanea* Brady.
„ *tenera* Brady.
„ *semipunctata* Brady.
„ *convexa* Baird.
„ *pulchella* Brady.
„ *Robertsoni* Brady.
„ *crispata* Brady (= *cicatricosa* G. O. Sars).
*Cytheridea papillosa* Bosq.
„ *punctillata* Brady.
*Eucythere declivis* Norman.
*Loxoconcha guttata* Norman.
„ *tamarindus* Jones.
„ *viridis* Müller (= *elliptica* Brady).

*Loxoconcha pusilla* Brady and Robertson.
„ *impressa* Baird.
*Cytherura cellulosa* Norman.
„ *nigrescens* Baird.
„ *striata* G O. Sars.
„ *angulata* Brady.
„ *sella* G. O. Sars (=*cuneata* Brady).
„ *gibba* Müller (=*Robertsoni* Brady).
*Cytheropteron latissimum* Norman.
„ *nodosum* Brady.
*Pseudocythere caudata* G. O. Sars.
*Sclerochilus contortus* Norman.
*Paradoxostoma variabile* Baird.
„ *ensiforme* Brady.
„ *abbreviatum* G. O. Sars.
„ *flexuosum* Brady.
„ *Fischeri* G. O. Sars.
„ *orcadense* Brady and Robertson.
*Limnicythere inopinata* Baird.
„ *monstrifica* Norman.

## XXI.

# *A SECOND CONTRIBUTION TOWARDS A CATALOGUE OF THE AMPHIPODA AND ISOPODA OF THE FIRTH OF CLYDE AND WEST OF SCOTLAND.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

[Read 31st March, 1891.]

It is now fully two years since I laid before this Society the first contribution towards a List of the Amphipoda and Isopoda of the Firth of Clyde and West of Scotland, and, in preparing the second contribution, additions, as a matter of course, were more and more sparsely met with. To the former list of 170 species, there are now added 60, many of which are new to Scotland and some recently new to science. With few exceptions, they have all been taken in the Firth of Clyde.

In the preparation of this list, I have been greatly indebted to the Rev. Canon Norman for his help; and to the Rev. T. R. R. Stebbing, who has determined most of the critical species, and has carefully gone over the whole of the manuscript before it has been printed. Whatever merits it may contain are therefore due to him.

## Order AMPHIPODA.

### Genus Socarnes, Boeck.

#### Socarnes vahlii (Kröyer).

*Lysianassa Vahlii*, Kröyer, Grönlands Amfipoder (1838), p. 5 (233).

*Anonyx Vahlii*, Kröyer, Naturh. Tidsskr., R. i. Bd. 2, p. 256; R. ii. Bd. 1, p. 599.

*Socarnes Vahli*, Boeck, Crust. amph. bor. et arct. (1870), p. 20.—Boeck, De Skand. og Arkt. Amph. (1872), p. 129; pl. vi. fig. 8.

*Habitat.*—Dredged in 6-7 fathoms, off the north side of the Clach Rock, Cumbrae.

SOCARNES ERYTHROPHTHALMUS, n. sp.

*Eyes* red, losing their colour in spirit.

*Upper Antennæ.* Principal flagellum consisting of thirteen joints, the first sometimes not noticeably longer than the second; the secondary flagellum consisting of four slender joints, the first occasionally rather longer than that of the principal flagellum.

*Lower Antennæ.* The gland-cone prominent, blunt; the fourth joint of the peduncle much longer than the fifth; the flagellum of a number of joints varying from six to nine, the third generally shorter than the second or fourth.

*Maxillipeds.* The apical margin in the inner plates is cut into three teeth, and slopes strongly downwards to the outer margin.

*First Gnathopods,* as in *Socarnes Vahlii* (Kröyer).

*Second Gnathopods.* At the lower hinder angle of the third joint there is a single long spiniform seta, instead of a group as in *Socarnes Vahlii*, and the hind margin of the hand is less produced, so that distally it has a squared appearance.

*Telson* apically narrowed, longer than the peduncle of the third uropods, the cleft not reaching beyond the middle, not dehiscent; the surface carrying some setules, and each apex having a couple.

*Length* of female specimens bearing eggs in an advanced condition, three-twentieths of an inch.

*Habitat.*—Castle Bay, Little Cumbrae, dredged in 4 fathoms, muddy sand; The Tan, Cumbrae, 8-10 fathoms; Rothesay Bay, 12-14 fathoms, bottom mud and small stones; Millport Bay, surface-net.

The colour of the eyes, the shape of the hand of the second gnathopods, and the diminutive stature,

clearly distinguish the species from *Socarnes Vahlii*, which in many respects it closely resembles.

This species has also been taken on the French Coast by Monsieur Jules Bonnier, who courteously refrained from publishing it, on learning that the description was already written for the present catalogue.

### PARARISTIAS, new genus.

This agrees in general with *Aristias*, Boeck, as redefined by Sars, but differs in the following points. The second antennæ have, at least in the female, a very short flagellum abruptly narrower than the peduncle. The first maxillæ have only three stout feathered setæ on the inner plate. The plates of the second maxillæ are not divergent. In the maxillipeds the palp scarcely projects beyond the large outer plate, and is quite devoid of the terminal unguiform joint, any division between the three preceding joints being almost imperceptible. The third pair of uropods do not reach at all beyond the preceding pair. The telson ends in a broad but shallow emargination.

*Pararistias audouinianus* is probably the same as the *Lysianassa Audouiniana* of Spence Bate, with the description of which it agrees very closely, except in regard to the telson, which Bate speaks of as "rounded at the apex." The present species has been described and well figured by Heller under the name of *Aristias* (Kröyer) juv. He figures the telson, however, as very much narrowed and rounded at the end, without either cleft or emargination. His specimen was an eighth of an inch long, and this condition of the telson may appertain to an early age. He also states that the maxillipeds are entirely devoid of inner plates, but this is no doubt due to his having overlooked them. They are very small, and are apically surmounted with two or three rather spine-like setæ. The species differs not only by the generic characters, but in a number of

other small particulars, from that which Sars has described under the name "*Aristias audouinianus* (Sp. Bate)," as also from his *Aristias tumidus* (Kröyer), and inferentially also from *Aristias neglectus*, Hansen. In *Pararistias audouinianus* the first antennæ have the secondary flagellum two-jointed, the primary four-jointed; the second antennæ (in the female) have a very short and slender four-jointed flagellum. The mandibles agree very nearly with Heller's figure, one of them at least having the singular oblique spine-row in the position from which the molar tubercle more commonly arises; the other mandible has a single spine near the straight cutting edge; the second joint of the palp is very elongate and carrying a single spine, the third has three spines and a coating of fine hairs. In the first maxillæ the outer plate appears to have only seven spines, which are surrounded by a crowd of hairs; the palp has only three apical spines, near to which the outer margin is more or less serrate. The second maxillæ have about a dozen setæ on the broad inner plate, and about half-a-dozen on the narrower outer plate. The peræopods are remarkable for the almost entire absence of spines, which might be thought a juvenile characteristic, but it is found unchanged in an ovigerous female. In all five pairs the antepenultimate joint is very short, in the last three pairs almost completely overlapped behind by the broad and produced preceding joint. All the uropods have the branches fringed on both edges with microscopic spines, except the third pair, in which the outer two-jointed branch is fringed only on the inner margin.

Spence Bate only knew of the species from Plymouth Sound. To the Clyde habitat must be added Liverpool Bay, from which Mr. A. O. Walker has obtained it. Mr. Walker informs me that a new genus *Perrierella* has just been described by Monsieur Chevreux which is probably identical with *Pararis-*

*tias.* In the absence of more precise information, and on the eve of going to press, the latter name must take its chance of becoming a synonym.

### Genus HIPPOMEDON, Boeck.

#### HIPPOMEDON DENTICULATUS (Spence Bate).

*Anonyx denticulatus,* Sp. Bate, Report Brit. Assoc. for 1855 (1856), without description.—Sp. Bate, Synopsis Brit. Edr. Crust., Ann. and Mag. Nat. Hist., Ser. 2., vol. 19 (1857). — Sp. Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 74; pl. xii. fig. 2.—Bate and Westwood, Brit. Sess. Crust., vol. i. (1861), p. 101.

*Hippomedon denticulatus,* Hansen, Malacostraca marina Groenlandiæ occidentalis (1887), p. 65; tab. ii. fig. 2-2b.

*Habitat.*—Dredged between the "Allans," Cumbrae, 4-5 fathoms, coarse sand. When taken it was of a beautiful salmon-colour, with the eyes bright red.

### Genus SOPHROSYNE, Stebbing.

#### SOPHROSYNE ROBERTSONI, Stebbing and Robertson.

*Sophrosyne robertsoni,* Stebbing and Robertson, Trans. Zool. Soc., vol. 13, part 1 (1891—separate copy 1890), p. 31; pl. 5.A.

*Habitat.*—The Clyde.

### Genus ORCHOMENELLA, G. O. Sars.

#### ORCHOMENELLA PINGUIS (A. Boeck).

*Anonyx pinguis,* A. Boeck, Forhandl. ved de Skand. Natur., 8de möde (1860), p. 642.—Lilljeborg, On the Lysianassa magellanica, etc. (1865), p. 29.

*Orchomene pinguis,* A. Boeck, Crust. amph. bor. et arct. (1870), p. 35.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 176; pl. v. fig. 1.

*Orchomenella pinguis,* G. O. Sars, Crustacea of Norway, Amphipoda, part 3 (1890), p. 67; pl. 24, fig. 2.

*Habitat.*—Dredged west of Tan Buoy, Cumbrae, in 18 fathoms, bottom mud, shells and gravel.

ORCHOMENELLA CILIATA, G. O. Sars.

*Tryphosa ciliata*, G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl. (1882), No. 18, p. 81; tab. 3, fig. 4.

*Orchomenella ciliata*, G. O. Sars, Crustacea of Norway, Amphipoda, part 4 (1891), p. 69; pl. 25, fig. 2.

Sars gives the colour as greyish-white, with light-red eyes. The Clyde specimens are salmon-coloured, with the eyes bright-red; but in other respects they agree very exactly with the description and figures given by Sars of this species.

*Habitat.*—Dredged west of the Tan Buoy, Cumbrae, at a depth of 14 fathoms.

This seems to be one of the sea-scavengers. A fisherman brought me portions of the crab *Lithodes maia* from his bait-creel, and every part of it was crowded with this species, clustered on the top of each other. All the flesh was as perfectly cleaned off the body, legs, and claws of the crab, as if the parts had been bleached on the shore for a twelvemonth. The number of these amphipods was quite surprising, and I had a six-ounce bottle filled with them. So far as I have seen, they are all of the same species. The wonder is why they remained on the empty shell of the crab after having cleaned out all the soft parts, unless, like the Boa Constrictor after a great feast, they require a long time to digest it.

I put some forty or fifty of them into a basin of clean sea-water, and for about a week they clustered much on the top of each other, so as to form little heaps. After that time they separated, and swam freely through the water. I killed a small shore-crab, broke it open, and put it in the basin beside them, but not one of them appeared to touch it. The crab began to decompose, and caused the water to smell offensively. Many of the amphipods then sickened and died; and the few survivors were put into clean sea-water, where they also died after a short time.

Seldom finding these animals in the dredge, and wishing to see if they burrowed, I put some of them

into a basin with sand and sea-water, but none made any attempt to burrow.

It is a curious fact that the amphipoda met with at these great banquets, so far as I have seen, are mostly of one species. Sometimes they are exclusively *Tryphosa nanoides*, or at other times wholly *Lafystius sturionis*, *Orchomenella ciliata*, or *Callisoma crenatum*. Whether each species has its own particular prey, or whether the weaker species give way to the stronger, cannot easily be proved.

### Genus ORCHOMENE, Boeck.

#### ORCHOMENE BATEI, G. O. Sars.

*Anonyx Edwardsii*, S. Bate (not Kröyer), Brit. Mus. Catal. Amph. Crust. (1862), p. 73; pl. xi. fig. 5.

*Anonyx Edwardsi*, Bate and Westwood, Brit. Sess. Crust., vol. i. (1861), p. 94.

*Orchomene Batei*, Sars, Oversigt af Norges Crustaceer, Christiania Vidensk.-Selsk. Forhandl. 1882, No. 18, p. 81.—Sars, Crustacea of Norway, Amphipoda, part 3 (1890), p. 60; pl. 22.

? *Anonyx melanophthalmus*, Norman, Report Brit. Assoc. 1866 (1867), p. 201.

*Habitat.*—Between the Tan Buoy and Bute, in 18 fathoms; Loch Striven, in 20 fathoms; Lochgoil, in 30 to 40 fathoms; and Lochfyne, in 10 to 12 fathoms.

### Genus TRYPHOSA, Boeck.

#### TRYPHOSA NANUS (Kröyer).

*Anonyx nanus*, Kröyer, Naturh. Tidsskr., 2 R. 2 B. (1846), p. 30.

*Tryphosa nanus*, A. Boeck, Crust. amphip. bor. et arct. (1870) p. 37.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 181.

*Habitat.*—Dredged off Fairland Point, Cumbrae, in 23 fathoms, bottom sandy gravel and full of living organisms. It is my impression that such living organisms are seldom plentiful when the bottom is covered with dead animal remains.

TRYPHOSA PUSILLA, G. O. Sars.

*Anonyx (Tryphosa) pusillus*, Sars, Crust. et Pycnon. nova, Arch. Math. Nat., Bd. 4 (1879), p. 439.

*Tryphosa pusilla*, Sars, Norwegian North Atlantic Expedition, Crust., vol. 1 (1885), p. 151; pl. 13, fig. 2.

*Habitat.*—Dredged at the Tan, Cumbrae, in 12 fathoms.

### Genus Hoplonyx, G. O. Sars.

HOPLONYX SIMILIS, Sars.

*Hoplonyx similis*, Sars, Crustacea of Norway, Amphipoda, part 5 (1891), p. 93; pl. 33, fig. 1.

*Habitat.* — Off Fairland Point, Cumbrae, in 20 fathoms.

### Genus Normania, Boeck.

NORMANIA QUADRIMANA (Bate and Westwood).

*Opis quadrimana*, Bate and Westwood, Brit. Sess. Crust. (1868), vol. ii., p. 503.

*Normania quadrimana*, A. Boeck, Crust. amphip. bor. et arct. (1870), p. 40. — A. Boeck, De Skand. og Arkt. Amph. (1876), p. 188; pl. vi. fig. 3.—G. O. Sars, Crustacea of Norway, Amphipoda, part 2 (1890), p. 33; pl. 13, fig. 1.

*Habitat.* — Dredged by Dr. Norman and myself off Fairland Point, Cumbrae, in 20-25 fathoms.

### Genus Argissa, Boeck.

ARGISSA TYPICA, Boeck.

*Argissa typica*, Boeck, Crust. amphip. bor. et arct. (1870), p. 45.—Boeck, De Skand. og Arkt. Amph. (1876), p. 206.—H. J. Hansen, Malacostraca marina Groenlandiæ occidentalis (1887), p. 85.—Giard and Bonnier, Faune Marine de Wimereux, Bull. Sci. de la France et de la Belgique (1889). — G. O. Sars, Crustacea of Norway, Amphipoda, part 7 (1891), p. 141; pl. 48.

*Habitat.*—Kilchattan Bay, in 8-9 fathoms, muddy sand and dead shells. Two specimens were obtained, male and female, the antennæ of the male being very distinct from those of the other sex.

## Genus PHOXOCEPHALUS, Stebbing.

### PHOXOCEPHALUS FULTONI, T. Scott.

*Phoxocephalus fultoni*, T. Scott, Eighth Annual Report, Fishery Board for Scotland, pt. 3 (1890), p. 327; pl. xii. figs. 10-12, and pl. xiii.

The lower hinder angle of the third pleon-segment rounded.

*Eyes* oval, black, retaining the colour in spirit.

*Upper Antennæ.* Principal flagellum consisting of five slender joints, the last one tipped with a very long seta; the secondary flagellum three-jointed.

*Lower Antennæ.* In the male the third and fourth joints of the peduncle are hirsute above; the flagellum consisting of twenty-three slender joints, with a calceolus on each of the first three joints, and then on every alternate joint.

*Mandibles.* Secondary plate of left mandible having six teeth; the third joint of the palp having one setiform spine on the side and eight such spines on the apex.

*First Maxillæ.* The one-jointed palp tipped with three setæ.

*First Gnathopods.* Side-plates widened below, carrying three or four setules. The wrist narrow, triangular, its front margin nearly as long as that of the hand; the hand much longer than broad, the upper hinder angle rounded, the hind margin for some distance parallel to the front, then slightly diverging and ending in a pronounced tooth so much in advance of the front margin that the smooth convex palm, instead of as commonly sloping up, in this case slopes down from the hinge of the finger to the apical tooth of the hind margin. The finger curves round the palm, fitting into the cavity of the tooth just mentioned, which carries a small spine on its inner side. The various joints have only one or two setæ apiece. The palm is bordered with setules.

*Second Gnathopods.* These have a general simi-

larity to the first, but the third joint has the hinder angle acute instead of rounded, the wrist is shorter, and the hand is considerably broader, while the hind margin is not produced so much in advance of the front, so that the downward slope of the palm is less steep.

*First and Second Peræopods.* Apical spine of the fourth joint shorter than the fifth joint.

*Third Peræopods.* The hind margin of the first joint nearly smooth.

*Fourth Peræopods.* The first joint with its front margin convex or almost angled, carrying three single setæ on the upper part and five groups on the lower part; the hind margin almost smooth.

*Fifth Peræopods.* The first joint with nearly straight front margin, the hind margin serrate but not deeply, the joint widely expanded, especially below, where the rounded margin reaches beyond the short second joint.

*Length,* a little over one-tenth of an inch.

*Habitat.*—The specimen described, shown by the lower antennæ to be an adult male, was taken at low water in muddy sand at Cumbrae.

The preliminary description above given was written before the species had been described and figured by Mr. Scott; and as it adds some details and corroborates others, it has been thought worth while to print it.

### Genus MONOCULODES, Stimpson.

#### MONOCULODES PACKARDI, A. Boeck.

*Monoculodes Packardi,* A. Boeck, Crust. amphip. bor. et arct. (1870), p. 86.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 274; pl. xiv. fig. 3.—J. Sp. Schneider, Norges Œdicerider (1883), p. 27; pl. 1, fig. 6. —A. M. Norman, Notes on British Amphipoda, Ann. and Mag. Nat. Hist., June, 1889, p. 453.

This species has a long narrow rostrum with the small eye situated at its base. In both pairs of antennæ the peduncles are elongate. In the third

and fourth peræopods the terminal joint is very long. The oval telson has two spinules at the centre of its smoothly rounded apex.

*Habitat.*—Taken in the tow-net in Loch Striven, at a depth of 40 fathoms. The net had touched the bottom.

MONOCULODES BOREALIS, A. Boeck.

*Œdiceros affinis*, Goës, Crust. Amph. Maris Spetsb., p. 11, fig. 21 (non Bruzelius).

*Monoculodes borealis*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 88.

*Habitat.*—Dredged off Blackwaterfoot, Arran, in 20 fathoms, bottom muddy sand.

Genus WESTWOODILLA, Spence Bate.

WESTWOODILLA PARVIMANUS, Bate and Westwood.

*Westwoodea cæculus*, Bate, Rep. Brit. Assoc. for 1855 (1856).

*Westwoodia cæcula*, Bate, Synopsis Brit. Edr. Crust., Ann. and Mag. Nat. Hist., ser. 2, vol. 19. (1857), p. 139.

*Westwoodilla cæcula*, Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 102; pl. xvi. fig. 5.—Bate and Westwood, Brit. Sess. Crust., vol. 1. (1862), p. 155.

*Westwoodilla hyalina*, Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 103; pl. xvii. fig. 5.—Bate and Westwood, Brit. Sess. Crust., vol. 1. (1862), p. 158.

*Œdiceros parvimanus*, Bate and Westwood, Brit. Sess. Crust., vol. 1. (1862), p. 161.

*Halimedon Mölleri*, Boeck, Crust. amph. bor. et arct. (1870), p. 89.

*Halimedon Mülleri*, Boeck, De Skand. og Arkt. Amph. (1876), p. 281; pl. xiii. fig 5.

**Halimedon parvimanus*, Norman, Ann. and Mag. Nat. Hist., June, 1889, p. 455; pl. 20, figs. 10-14.

*Habitat.*—Off Blackwaterfoot, Arran, in 20 fathoms, muddy sand.

* In the last-mentioned paper, the Rev. Canon Norman unites the various synonyms above given, and rejects the earlier generic name *Westwoodilla* on the ground of misdescription; but it is here reinstated under the influence of a more rigid regard for priority, and a less rigorous view of the penalties proper to human error.

### Genus PONTOCRATES, Boeck.

#### PONTOCRATES HAPLOCHELES, Grube.

*Kröyeria haplocheles*, Grube, Die Insel Lussin, etc. (1864), p. 72.

*Kröyeria brevicarpa*, Bate and Westwood, Brit. Sess. Crust., vol. ii. (1868), p. 508.

*Pontocrates haplocheles*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 92.

*Habitat.*—Dredged at Blackwaterfoot, Arran, in five and six fathoms, bottom sand; and at Kames Bay, Cumbrae, in five fathoms, bottom sand.

### Genus TRITÆTA, Boeck,

#### TRITÆTA GIBBOSA (Spence Bate).

*Atylus gibbosus*, Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 137; pl. xxvi. fig. 3.—Bate and Westwood, Brit. Sess. Crust., vol. i. (1863), p. 248, with figure.

*Lampra gibbosa*, Boeck, Crust. amph. bor. et arct. (1870), p. 108.

*Tritæta gibbosa*, Boeck, De Skand. og Arkt. Amph. (1876), p. 318; pl. xii. fig. 2.

*Dexamine dolichonyx*, Nebeski, Beiträge zur Kenntniss der Amphipoden der Adria, p. 35, fig. 40.—Chevreux, Extrait du *Bulletin de la Société d'études scientifiques de Paris*, 11e année, 1er semestre 1888, p. 8.

*Tritæta dolichonyx*, Stebbing, Challenger Amphipoda (1888), pp. 520, 945.

*Habitat.*—Dredged near the Tan Buoy, Cumbrae, in seven fathoms, bottom broken shells and *Melobesia*.

The Clyde specimens agree with *Dexamine dolichonyx*, Nebeski, in having the peculiar incision in the upper or front margin of the hands of one of the gnathopods; but according to our experience this peculiarity belongs to the first gnathopods, not to the second, to which Nebeski ascribes it. Moreover, it has been observed in a female specimen, so

that probably the unnotched form of the hand belongs to individuals not adults, unless the species *gibbosa* and *dolichonyx* are distinct. In uniting his own *Tritæta gibbosa* with Spence Bate's *Atylus gibbosus,* Boeck assumes that Spence Bate has committed some errors of observation. It is indeed almost certain that he has transposed the gnathopods, probably through taking it for granted that the larger hand would belong to the second pair, whereas in the present instance it really belongs to the first.

### Genus HALIRAGES, Boeck.

HALIRAGES BISPINOSUS (Spence Bate).

*Dexamine bispinosa,* S. Bate, Synopsis Brit. Edr. Crust., Ann. and Mag. Nat. Hist., ser. 2, vol. 19. (1857), p. 142.

*Amphithoë macrocephala,* M. Sars, Overs. over norsk-arct. Krebsdyr, Forh. i. Vid.-Selsk. i. Christiania (1858), p. 142.

*Paramphithoë elegans,* Bruzelius, Skand. Amph. Gamm. (1859), p. 75, fig. 14.

*Amphithopsis elegans,* A. Boeck, Forh. ved de Skand. Naturf., 8de möde (1860), p. 662.

*Atylus bispinosus,* Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 140; pl. xxvii. fig. 1.—Norman, Rep. on the Shetland Crustacea (1869), p. 280.

*Halirages bispinosus,* A. Boeck, Crust. amph. bor. et arct. (1870), p. 115.

*Habitat.*—Common in the Firth of Clyde.

By some neglect this species was omitted from my first contribution.

Dr. Norman thinks that Spence Bate has perhaps mistaken the male of this species for *Pherusa bicuspis.*

### Genus CALLIOPIUS, Lilljeborg.

CALLIOPIUS NORVEGICUS (Rathke).

*Amphithoë norvegica,* Rathke, Beitr. z. Fauna Norwegens, Act. Leop. 1843; tab. xx. p. 83, tab. 4, fig. 6.

*Paramphithoë norvegica,* Bruzelius, Skand. Amph. Gamm. (1859), p. 77.

*Calliope norvegica,* Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 150.

*Calliopius norvegicus,* A. Boeck, Crust. amph. bor. et arct. (1870), p. 118.

*Habitat.*—Between tide-marks, on the borders of rock-pools fringed with green seaweed and *Corallina officinalis,* Fairland Point, Cumbrae. This species may readily be mistaken for *Calliope læviuscula,* but is known by the armature of the under margin of the peduncle of the upper antennæ and the hind margin of the third segment of the pleon

### Genus AMPHITHOPSIS, Boeck.

#### AMPHITHOPSIS NODIFERA, G. O. Sars.

*Amphithopsis nodifera,* Sars, Oversigt af Norges Crustaceer, Christiania Vidensk.-Selsk. Forhandl., 1882, p. 103; tab. 5, fig. 6 a-b.

*Habitat.*—Dredged off north side of Little Cumbrae, in 20 fathoms, gravelly mud; and off Fairlie Perch, in 20 fathoms.

### Genus MELITA, Leach.

#### MELITA GLADIOSA, Spence Bate.

*Melita gladiosa,* S. Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 185; pl. xxxiii. fig. 6.

*Habitat.*—Taken between the "Allans," Cumbrae, in 4-5 fathoms, bottom weeds, sand, and gravel.

### Genus CHEIROCRATUS, Norman.

#### CHEIROCRATUS ASSIMILIS (Lilljeborg).

*Gammarus assimilis,* Lilljeborg, Öfv. af Kgl. Vet.-Akad. Förh. 1851, p. 23.—Lilljeborg, Kgl. Vet.-Akad. Handl. 1853, p. 445.—Bruzelius, Skand. Amph. Gamm. (1859), p. 58.—Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 214.

*Cheirocratus Mantis,* Norman, Trans. Nat. Hist. Soc. Northumberland and Durham, vol. i. (1865),

p. 12.—Bate and Westwood, Brit. Sess. Crust., vol. ii. (1868), App. p. 513.

*Cheirocratus assimilis,* Boeck, Crust. amph. bor. et arct. (1870), p. 134.—Boeck, De Skand. og Arkt. Amph. (1876), p. 398.—Norman, Ann. and Mag. Nat. Hist., ser. 6, vol. 4 (1889), p. 120.

*Habitat.*—Lower Loch Fyne, in 104 fathoms, bottom mud, and off Fairland Point, Cumbrae, in 20 fathoms.

In the former Catalogue this species was prematurely included, under a misapprehension of the place of capture.

### Genus MELPHIDIPPA, Boeck.

#### MELPHIDIPPA SPINOSA, Boeck.

*Gammarus spinosus,* Goës, Crust. amph. maris Spetsberg., 1865 (1866), p. 14, fig. 30.

*Melphidippa spinosa,* A. Boeck, Crust. amph. bor. et arct. (1870), p. 139.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 417; pl. xxiii. fig. 4.

*Habitat.* Dredged on north side of Little Cumbrae, in 20 fathoms, gravelly mud.

The species of this genus appear to be very closely related. Hansen, *Overs. Dijmphna - Togtet inds. Krebsdyr,* p. 229, supposes that possibly Boeck's species is not the same as that of Goës. In the specimen examined, the inner plate of the first maxillæ is surmounted by seven setæ, the third joint of the second gnathopods is produced to a sharp point, and the first joint of the fifth peræopods has the lower hinder angle a little produced. These points seem to distinguish the species from Boeck's *Melphidippa longipes,* which has recently been shown to be *Melphidippa macra,* Norman.

#### MELPHIDIPPA MACRA, Norman.

*Atylus macer,* Norman, Last Report Dredging Shetland, Report Brit. Assoc. for 1868 (1869), p. 280.

*Melphidippa longipes,* Boeck, Crust. amph. bor. et arct. (1870), p. 139.—Boeck, De Skand. og Arkt. Amph. (1876), p. 414; pl. xxiv. fig. 5.

*Melphidippa macra*, Norman. Ann. and Mag. Nat. Hist., ser. 6, vol. 4 (1889), p. 121; pl. x. fig. 14; and pl. xii. figs. 4-7.

*Habitat.*—North side of Little Cumbrae, in 20 fathoms, bottom gravelly mud.

Genus STEGOCEPHALOIDES, G. O. Sars.

STEGOCEPHALOIDES CHRISTIANIENSIS (Boeck).

*Stegocephalus christianiensis*, Boeck, Crust. amph. bor. et arct. (1870), p. 48.—Boeck. De Skand. og Arkt. Amph. (1876), p. 424; pl. viii. fig. 4; pl. ix. fig. 1.

*Stegocephaloides christianiensis*, Sars, Crustacea of Norway, Amphipoda, part 9 (1891), p. 202; pl. 70, fig. 2.

*Habitat.*—Lochfyne, in 40-70 fathoms.

Genus AMPHILOCHOIDES, G. O. Sars.

AMPHILOCHOIDES ODONTONYX (A. Boeck).

*Amphilochus odontonyx*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 51.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 434; pl. xi. fig. 3.

*Amphilochoides odontonyx*, Sars, Crustacea of Norway, Amphipoda, part 10 (1892), p. 221; pl. 75, fig. 2.

*Habitat.*—Dredged off Blackwaterfoot, Arran, in 20 fathoms, bottom sand and mud.

Genus GITANOPSIS, G. O. Sars.

GITANOPSIS BISPINOSUS (A. Boeck).

*Amphilochus bispinosus*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 51.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 435; pl. x. fig. 1.

*Gitanopsis bispinosa*, Sars, Crustacea of Norway, Amphipoda, part 10 (1892), p. 224; pl. 76, fig. 2.

*Habitat.*—Dredged off Blackwaterfoot, Arran, in 20 fathoms, bottom sand and mud.

Genus GITANA, Boeck.

GITANA SARSI, Boeck.

*Gitana Sarsi*, Boeck, Crust. amph. bor. et arct. (1870), p. 52.—Boeck, De Skand. og Arkt. Amph. (1876), p. 439; pl. xi. fig. 2.

*Amphilochus Sabrinæ*, Stebbing, Ann. and Mag. Nat. Hist., ser. 5, vol. ii. (1878), p. 364; pl. xv. fig. 1.

*Gitana Sarsii*, Sars, The Norwegian North-Atlantic Expedition, Crustacea, II. (1886), p. 47.—Sars, Crustacea of Norway, Amphipoda, part 10 (1892), p. 228; pl. 78, fig. 1.

*Amphilochus Sabrinæ*, Stebbing, Challenger Amphipoda (1888), p. 484

*Gitana Sarsi*, Chevreux, Bulletin de la Soc. Zool. de France, 28 février, 1888.—Stebbing, Challenger Amphipoda (1888), p. 1650

*Habitat.*—Dredged in Kilchattan Bay, in five fathoms, muddy sand.

Genus CYPROIDIA, Haswell.

CYPROIDIA DAMNONIENSIS, Stebbing.

*Cyproidia damnoniensis*, Stebbing, Ann. and Mag. Nat. Hist., Jan., 1885, p. 59, pl. 2.

Mr. Stebbing informs me that he is doubtful now as to the propriety of referring this species to Haswell's genus *Cyproidia*. It may more probably belong to the genus *Peltocoxa*, Catta, which has never been fully described.

*Habitat.*—Dredged off Blackwaterfoot, Arran, in 20 fathoms, bottom muddy sand; and off Fairland Point, Cumbrae, in 19 fathoms, bottom small gravel.

Genus METOPA, Boeck.

METOPA RUBROVITTATA, G. O. Sars.

*Metopa rubrovittata*, G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl. 1882, No. 18, p. 90; tab. 4, fig. 2, 2a.

*Habitat.*—Dredged in 10-15 fathoms, off the north side of Little Cumbrae.

METOPA BOREALIS, G. O. Sars.

*Metopa borealis*, G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl. 1882, No. 18, p. 91; tab. 4, fig. 4, 4a.

*Habitat*—Dredged off Fairland Point, Cumbrae, in 20 fathoms.

METOPA NASUTA, A. Boeck.

*Metopa nasuta*, A. Boeck, De Skand. og Arkt. Amph. (1876), p. 465; pl. xviii fig. 6.

*Habitat.*—A few specimens were dredged off Fairland Point, Cumbrae, in 19 fathoms, bottom gravel and mud.

The eyes are small and red. The first joint of the upper antennæ projects a little over the second joint.

## Genus PROBOLIUM, Costa.

PROBOLIUM SERRATIPES, Norman.

*Probolium serratipes*, Norman, Last Report on Dredging among the Shetland Isles, Brit Assoc. Report for 1868 (1869), p 273.

*Habitat.*—Dredged off the Clach Rock, Cumbrae, in seven fathoms. The animal is dotted all over with purple marking.

It has not yet been determined whether this species belongs to the genus *Metopa*, Boeck, or to *Stenothoe*, Dana, or to *Probolium* as now reinstated by Sars.

## Genus SYRRHOE, Goës.

SYRRHOE FIMBRIATUS, Stebbing and Robertson.

*Syrrhoe fimbriatus*, Stebbing and Robertson, Trans. Zool. Soc. London, vol. 13, part 1. (1891—separate copy 1890), p. 34; pl. 5. B.

*Habitat.*—Clyde.

## Genus BRUZELIA, Boeck.

BRUZELIA TYPICA, A. Boeck.

*Bruzelia typica*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 70.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 478; pl. x. fig. 3.—G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl. (1882), No. 18, p. 24.

*Habitat.*—Dredged west of Tan Buoy, Cumbrae, in 12-20 fathoms.

### Genus Liljeborgia, Spence Bate.

#### LILJEBORGIA PALLIDA, Spence Bate.

*Gammarus pallidus*, S. Bate, Report Brit. Ass. for 1855 (1856), p. 55.—S. Bate, Synopsis Brit. Edr. Crust., Ann. and Mag. Nat. Hist., ser. 2, vol. 19 (1857), p 145.

*Gammarus brevicornis*, Bruzelius, Skand. Amph. Gamm. (1859), p. 62; pl iii. fig. 11.

*Liljeborgia pallida*, S. Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 118; pl 20, fig. 5.—A. Boeck, Crust. amph. bor. et arct. (1870), p. 75.—A. Boeck, De Skand. og Arkt Amph. (1876), p. 497; pl. xviii. fig. 9

*Habitat.*—Dredged off Fairland Point, Cumbrae, in 23 fathoms, bottom small gravel.

### Genus Leucothoe, Leach.

#### LEUCOTHOE INCISA, new name.

*Leucothoe furina*, Chevreux, Extrait du *Bulletin de la Société d'études scientifiques de Paris*, 11e année, 1er semestre, 1888, p. 9.—Norman, Ann. and Mag. Nat. Hist., ser. 6, vol iv. (1889), p 114.

*Habitat.*—Balloch Bay, Cumbrae, at low water. Dredged off Fairland Point, Cumbrae, in 20 fathoms.

M. Chevreux was the first to publish any observation on the distinguishing feature of this species, namely, that the hind margin of the third pleon-segment is incised below, so that the angle forms a kind of hook M. Chevreux supposed that this feature had been overlooked by Spence Bate in his account of *Leucothoe furina* (Savigny), but neither the careful figure of *Lycesta furina* in Savigny's *Egyptian Crustacea*, plate xi. fig 2, shows any trace of the incision, nor is it found in those British specimens of *Leucothoe* which most closely agree with Savigny's species.

### Genus Iphimedia, Rathke.

#### IPHIMEDIA MINUTA, G. O. Sars.

*Iphimedia minuta*, G. O. Sars, Oversigt. af Norges Crust., Christiania Vidensk.-Selsk. Forhandl. 1882, No. 18, p. 100; tab. 5, fig. 2, 2a.

*Habitat.*—Off Fairland Point, Cumbrae, in 20 fathoms, mud and shells.

### Genus MEGAMPHOPUS, Norman.

#### MEGAMPHOPUS CORNUTUS, Norman.

*Megamphopus cornutus*, Norman, Last Report on Dredging among the Shetland Isles, Report Brit. Assoc. for 1868 (1869), p. 282.

*Habitat.*—Off Fairland Point, Cumbrae, in 20-25 fathoms.

### Genus GUERNEA, Chevreux

#### GUERNEA COALITA (Norman).

*Helleria coalita*, Norman, Ann. and Mag. Nat Hist., Dec., 1868.

*Guernea coalita*, Chevreux, Catal. Amph. Bretagne, Bull. Soc. Zool. France, tome 12 (1887), p. 16 of separate copy.

In the *Ann. and Mag. Nat. Hist.* for February, 1890, Stebbing suggests that *Prinassus Nordenskiöldii*, Hansen, 1887, is probably a synonym of this species.

*Habitat.*—Taken by the surface-net on two different occasions off Millport, Isle of Cumbrae; and taken by the same means in Shetland by the Rev. Dr. Norman and the writer.

### Genus GAMMARELLA, Spence Bate

#### GAMMARELLA BREVICAUDATA (Milne-Edwards).

*Gammarus brevicaudus*, Milne-Edwards, Ann. des Sciences Nat., vol. 20 (1830), p. 369.

*Gammarus brevicaudatus*, Milne-Edwards, Hist. Nat. des Crust., vol. 3 (1840), p. 53.

*Gammarella brevicaudata*, Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p 180; pl. 32, fig 8.

The species entered in the first part of this Catalogue (*Trans. Nat. Hist. Soc. of Glasgow*, vol. ii., p. 51, separate copy p. 47) as *Gammarella Normani*, Spence Bate and Westwood, has proved, as those authors suggested, to be the female of the above, and not a distinct species. See *Brit. Mus. Catal.*

*Amph. Crust.*, p. 379; *Brit. Sessile-eyed Crustacea*, vol. i., p. 333; and *Ann and Mag. Nat Hist*, July, 1874, p. 13.

### Genus ERIOPISA, Stebbing.

#### ERIOPISA ELONGATA (Bruzelius).

*Eriopis elongata*, Bruzelius, Skand. Amph. Gamm. (1859), p. 65; pl. 3, fig. 12.—Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 178; pl. 32, fig 5.—Norman, Ann. and Mag. Nat. Hist. (1868), p. 415; pl. xxi. fig. 7-10.

*Niphargus elongatus*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 136. – A. Boeck, De Skand. og Arkt. Amph. (1876), p. 403; pl. xxii. fig. 5.

*Eriopsis elongata*, Wrześniowski, Über drei unterird. Gamm., Zeitschr. für wiss. Zool., 1890, p. 633.

The name *Eriopis* of Bruzelius being preoccupied was changed to *Eriopisa* by Stebbing, in February, 1890 (see *Annals and Magazine of Nat. Hist.* for that month). Shortly afterwards Dr. Wrześniowski proposed the form *Eriopsis*.

*Habitat.*—Taken in the Clyde by the Rev. Dr. Norman (in the yacht *Medusa*).

### Genus PHOTIS, Kröyer.

#### PHOTIS LÜTKENI, Boeck.

*Photis Lütkeni*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 153.

*Habitat.*—Dredged off the Clach Rock, Cumbrae, in 6-7 fathoms, muddy-weedy bottom.

### Genus MEGALUROPUS, Norman.

#### MEGALUROPUS AGILIS, Norman.

*Megaluropus agilis*, Norman, Ann. and Mag. of Nat. Hist., ser. 6, vol. iii., p. 446; pl. xviii. figs. 1-10.—Hoek, Crust. Neerland, Tids. der Nederland Dierk. Vereen, 2de Reeks, Deel II., p. 28; pl. vii. fig. 7; pl. viii. fig. 3; pl. ix. fig. 3.

*Habitat.*—In sandy mud, Garrison Bay and Kames Bay, Millport, Cumbrae.

The eyes are red, and projecting between the upper and lower antennæ. The branches of the third

uropods are lamellar, and broadly rounded at the distal end.

### Genus MICROPROTOPUS, Norman.

#### MICROPROTOPUS MACULATUS, Norman.

*Microprotopus maculatus*, Norman, Report Brit. Assoc. for 1866 (1867), p. 203.—Norman, Ann. and Mag. Nat. Hist., 1868, p. 419; pl. xxiii. figs. 7-11.

*Habitat.*—Taken in sandy mud at low water, in Garrison Bay and Kames Bay, Cumbrae.

The eyes are red with white network.

### Genus PROTOMEDEIA, Kröyer.

#### PROTOMEDEIA LONGIMANA, ♀, A. Boeck.

*Protomedeia longimana*, A. Boeck, Crust. amph. bor. et arct. (1870), p. 160.—A. Boeck, De Skand. og Arkt. Amph. (1876), p. 578; pl. xxv. fig. 4; pl. xxix. fig. 5.

*Habitat.*—Taken in Castle Bay, Little Cumbrae; and dredged off Blackwaterfoot, Arran, in 17 fathoms.

The specimen agrees in so many points with Boeck's description and figures that the determination is not very doubtful. Nevertheless it must be mentioned that the upper lip is a little excavate apically, whereas Boeck states that the upper lip is apically rounded, in the characters which he gives both for the family and the subfamily in which he places *Protomedeia*. Moreover, the fifth joint in the lower antennæ is longer than the fourth, and the flagellum is longer instead of shorter than the fifth joint of the peduncle. The outer branch of the third uropods is shorter than the inner, which agrees with Boeck's figure of the species, though it differs from the character of the genus. The apical margin of the telson is concave, whereas in Boeck's figure it is convex; but as he does not describe the telson, he had perhaps not been in a position to observe it accurately.

Whether this and the following species should be transferred to the genus *Ptilocheirus*, Stimpson, or

*Leptocheirus*, Zaddach, we do not here undertake to decide.

PROTOMEDEIA PECTINATA, Norman.

*Protomedeia pectinata*, Norman, Last Report on Dredging among the Shetland Isles, Report Brit. Assoc. for 1868 (1869), p. 283.

*Habitat.*—Castle Bay, Little Cumbrae, dredged in 2-3 fathoms, sand and mud

### Genus PODOCEROPSIS, Boeck.

PODOCEROPSIS PALMATUS, Stebbing and Robertson.

*Podoceropsis palmatus*, Stebbing and Robertson, Trans. Zool. Soc., vol. 13, part I. (1891—separate copy 1890), p. 36; pl. 6. A.

*Habitat.*—Dredged off the Clach Rock, Cumbrae, in 6-7 fathoms.

### Genus SUNAMPHITHOË, Spence Bate.

SUNAMPHITHOË GAMMAROIDES (Spence Bate)

*Amphithoë gammaroides*, Spence Bate, Brit. Mus. Catal. Amph. Crust. (1862), p. 235, pl. xli. fig. 4.

*Sunamphithoë gammaroides*, T. R. R. Stebbing, Ann. Nat. Hist., Aug., 1874, p. 114; pl. xi. and xii., fig. 3, 3a-f.

*Habitat.*—Dredged in Kames Bay, Cumbrae, in five fathoms, bottom pure fine sand.

### Genus PODOCERUS, Leach.

PODOCERUS CUMBRENSIS, Stebbing and Robertson.

*Podocerus cumbrensis*, Stebbing and Robertson, Trans. Zool. Soc, vol. 13, part I. (1891—separate copy 1890), p. 38; pl. 6 B.

*Habitat.*—Dredged off Fairland Point, Cumbrae, in 20 fathoms, muddy sand.

PODOCERUS MINUTUS, Sars.

*Podocerus minutus*, G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl., 1882, No. 18, p 112, tab. 6, fig. 6, 6a.

*Habitat.*—Taken amongst the algæ on the timbers of Millport Pier, Cumbrae.

PODOCERUS ISOPUS, A. O. Walker.

*Podocerus isopus*, Walker, Third Report on the Higher Crustacea of the L.M.B.C. District, Proc. Biol. Soc. Liverpool, 1889, p. 209; pl. 11, figs. 11-13—Walker, Trans. Biol. Soc. Liverpool, vol. 4 (1890), p. 250; pl. 16, fig. 7.

*Habitat.*—Taken on the "Allans," Cumbrae, half-tide. Dredged west of the Clach Rock, Cumbrae, in 18 fathoms, shelly-muddy sand. Dredged off Fairland Point, Cumbrae.

Genus DULICHIA, Kröyer.

DULICHIA PORRECTA, Spence Bate.

*Dulichia porrecta*, S. Bate, Ann. Nat. Hist, 2 ser., vol. xx. (1857), p. 526.—A. Boeck, Crust. amph. bor. et arct (1870), p. 184.—A Boeck, De Skand. og Arkt. Amph (1876), p 658; pl. xxx. fig. 2, 3

*Habitat.*—Dredged off Fairland Point, Cumbrae, in 23 fathoms, bottom shells and gravel

## ORDER ISOPODA.

Genus APSEUDES, Leach.

APSEUDES TALPA (Montagu).

*Cancer* (*Gammarus*) *talpa*, Montagu, Trans. Linn. Soc., vol. ix. (1808), p. 98; pl. 4, fig. 6.

*Apseudes talpa*, Leach, Edinburgh Encyclop., vol. 7 (1813-14), p. 404.

*Habitat.*—Taken amongst the roots of *Laminaria saccharina* at the Tan, Cumbrae, in seven fathoms.

Genus LEACIA, Johnston.

LEACIA DILATATA (Sars).

*Astacilla dilatata*, G. O. Sars, Oversigt af Norges Crust., Christiania Vidensk.-Selsk. Forhandl., 1882, No. 18, p. 63; tab. 2, fig. 3.

*Habitat.*—Dredged off Blackwaterfoot, Arran, in 20 fathoms, bottom sand and mud. Seven were taken, in all, upon two different occasions.

### Genus PLEUROGONIUM, G. O. Sars.

#### PLEUROGONIUM INERME, G. O. Sars.

*Pleurogonium inerme*, G. O. Sars, Oversigt af Norges Crust, Christiania Vidensk.-Selsk. Forhandl., 1882, No. 18, p. 67; tab. 2, fig. 5.

*Habitat.*—Dredged off Fairland Point, Cumbrae, in 23 fathoms, on hard ground.

#### PLEUROGONIUM SPINOSISSIMUM, G. O. Sars.

*Pleuracantha spinosissima*, G. O. Sars, Beretning om en i Sommeren 1865 foretagen zoologisk ved Kysterne af Christianias og Christiansands Stifter, 1866, p 30.

*Pleurogonium spinosissimum*, G. O. Sars, Oversigt af Norges Crustaceer, Christiania Vidensk.-Selsk. Forhandl., 1882, No. 18, p. 17.

*Habitat*—Off Fairland Point, Cumbrae, in 20-25 fathoms; dredged by Dr. Norman and myself.

#### VARIETY.

*Habitat.*—Off Fairland Point, Cumbrae, in 20-25 fathoms; dredged by Dr. Norman and myself.

### Genus LEPTOGNATHIA, G. O. Sars.

#### LEPTOGNATHIA LATICAUDATA, Sars.

*Leptognathia laticaudata*, Sars, Revision of Gruppen Isop. Chelifera (1880), p. 43.—Sars. Middelhavets Saxisopoder, Archiv. f. Math. og Naturvid, (1886), p. 353; tab. 15, fig. 14-17.

*Habitat.*—Off Fairland Point, Cumbrae, in 20 fathoms, gravelly mud.

### Genus SPHÆROMA, Latreille.

#### SPHÆROMA HOOKERI, Leach.

*Sphæroma Hookeri*, Leach, Edinburgh Encyclop., vol. vii. (1813-14), p. 433.—Bate and Westwood, Brit. Sess. Crust., vol. ii. (1868), p. 410.

*Habitat.*—Taken in a brackish pool on south side of Little Cumbrae.

XXII.

# *PRELIMINARY LIST OF THE MARINE ALGÆ OF THE OBAN DISTRICT.*

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[Read 24th November, 1891.]

So far as I am aware, no list of Marine Algæ from the numerous sea-lochs which open off the Firth of Lorne has ever been published; scattered references to Captain Carmichael's work, in Harvey's *Phycologia Britannica*, form, I believe, the only basis from which a start may be made in the investigation of what may be expected to be a very rich coast-line.

The present list does not pretend to be more than a preliminary one, drawn up during odd moments in a two-months' holiday spent in the district. My headquarters were at Connel Ferry, on Loch Etive, six miles east of Oban. The Loch is there very narrow, and celebrated for the well-known Falls of Lora. Interesting as these are to the geologist and the tourist, they form a serious impediment to the biologist. The currents are so rapid and perplexing that dredging is almost impossible save during the short period of still water at low and high tides. The dredge I used was simply an A-shaped frame, to which were securely attached numerous shark-hooks and tufts of frayed-out rope, to the strands of which were tied a number of large cod-hooks. In the wider reaches of the Loch, by Achnacree and Ardchattan, the dredge worked fairly well, but in the narrows it was with the utmost difficulty made to stay at the bottom. Shore-collections were also made at various points, more especially at the Falls

(where several rock-pools yielded a large number of species), on the islands opposite Ardchattan Church, at Bonawe and Achnacloich, and at the head of Loch Etive. Collections were also made in Loch Creran, on the shores of the Sound of Kerrara, and on some of the islets off Lismore (for the opportunity of visiting which I have to thank Mr. T. Sopwith of Kilcheran, Lismore).

The systematic attack on the Marine Algæ of the Clyde Area by the Committee of which Mr. George Murray, F.L.S., is Secretary, initiates, I trust, a thorough exploration of our coast-line. We have already Mr. E. A. L. Batters' admirable *List of the Marine Algæ of Berwick-on-Tweed*, and Mr. Traill's equally useful lists from the Firth of Forth and the Orkneys; while Mr. Batters has done good service by publishing, in the *Journal of Botany*, a check-list of the Marine Algæ of the Clyde. In time we may hope for a complete series of papers, embracing the entire coast-line from Berwick to the Mull of Galloway.

I have employed, for ease of reference, the nomenclature and classification of Holmes and Batters' *Revised List of British Marine Algæ*.* For convenience I have added localities observed by Carmichael and recorded in the *Phycologia Britannica*.

## CLASS THALLOPHYTA.

### SUB-CLASS ALGÆ.

### Series I.—*CYANOPHYCEÆ.*

### Cohort I.—CHROOCOCCINÆ.

### Order I.—CHROOCOCCACEÆ.

**Glœocapsa crepidinum**, Thur.—On the piles of the old pier at South Connel, and on wood-work under water at Bonawe.

### Order II.—CHAMÆSIPHONACEÆ.

**Dermocarpa prasina**, Crn. — On *Polysiphonia fastigiata* and other algæ, *passim*.

**Annals of Botany*, Vol. v., No. xvii.

**D. violacea**, Crn.—On old mussel-shells, Loch Etive.

**D. Schousbœi**, Born.—On *Rhodochorton floridulum*, South Connel.

Cohort II.—NOSTOCHINÆ.

Section 1. *Homocysteæ.*

Order I.—OSCILLARIACEÆ.

Tribe I.—**Oscillarieæ.**

**Oscillaria corallinæ**, Gom. (*O. litoralis*, Phyc Brit.).—Recorded by Carmichael as found at Appin "in pools along the muddy sea-shore, flooded by spring tides." The generic name is, according to Gomont, more correctly written "*Oscillatoria.*"

**Phormidium papyraceum**, Gom. (*Oscillatoria spiralis*, Phyc. Brit.)—"At Appin by rocks where birds are in the habit of nesting" (Carmichael).

Tribe II.—**Lyngbyeæ.**

**Lyngbya æstuarii**, Liebm. (*L. ferruginea*, Phyc. Brit.).—"In small mud-bottomed pools of brackish water, Appin" (Carmichael). In similar situations near Dunstaffnage Point.

**L. majuscula**, Harv.—In rock-pools at high tide-mark on small islands opposite Lismore.

Section 2. *Heterocysteæ.*

Order II.—RIVULARIACEÆ.

**Calothrix pulvinata**, C. Ag. (*C. hydnoides* et *C. pannosa*, Phyc. Brit.).—"Clay sea-shore, Appin" (Carmichael). Ardmucknish Bay.

**C. fasciculata**, C. Ag.—On rocks on small islands opposite Lismore, and at Dunstaffnage.

**Rivularia atra**, Roth, var. **hemisphærica.**—On old *Patella* shells, and rocks near the Falls of Lora.

**R. nitida**, C. Ag. (*R. plicata*, Phyc. Brit.).—"On rocks at high water, Appin" (Carmichael). On rocks at Dunstaffnage and in the Sound of Kerrara.

Order V.—NOSTOCACEÆ.

**Anabæna torulosa**, Lagerh. (*Sphærozyga Carmichaelii*, Phyc. Brit.).—"On decaying algæ, Appin"

(Carmichael). On drift thrown up by high tides opposite Connel.

### Series II.—*CHLOROPHYCEÆ.*

### Cohort I.—CONFERVINÆ.

### Order II.—ULVACEÆ.

**Monostroma Grevillei**, J. Ag., (*Ulva lactuca* et *Enteromorpha cornucopiæ*, Phyc. Brit.). — Fairly common in Loch Etive and at Lismore. "On *Corallina*, Appin" (Carmichael).

**Enteromorpha clathrata**, J. Ag.—In Ardchattan Bay and elsewhere in Loch Etive.

**E. percursa**, C. Ag., var. **ramosa**, T. Ag.—"At half tide, Appin" (Carmichael).

**E. Linkiana**, Grev.—"Between tides, Appin" (Carmichael).

**E. compressa**, Grev.—Exceedingly common in Loch Etive, on Lismore, in the Sound of Kerrara, and elsewhere in the district.

**E. intestinalis**, Link—At various places on the shores of Loch Etive. I have not attempted to name the varieties of this variable plant.

**E. Linza**, J. Ag., var. **lanceolata** (*Ulva Linza*, Phyc. Brit.).—Several fine specimens of this variety were obtained from Loch Etive opposite the Black Crofts.

**Ulva latissima**, J. Ag.—Abundant but small, *passim.*

### Order IV.—CHÆTOPHORACEÆ.

**Entoderma Wittrockii**, Wittr.—On *Pylaiella* at various places in the district.

**Epicladia flustræ**, Rke.—On *Flustra*, and several species of Zoophytes in Loch Etive.

### Order V.—CLADOPHORACEÆ.

**Urospora penicilliformis**, Aresch. (*Conferva Youngana*, Phyc. Brit.).—Rare, in rock-pools near the Falls of Lora.

**U. bangioides**, Holm. et Batt.—Common in the district. I had an opportunity of re-examining this

species, whose life-history I had previously worked out,* and was able to confirm my previous account in all particulars.

**U. flacca**, Holm. et Batt. (*Lyngbya flacca* et *L. Carmichaelii*, Phyc. Brit.).—This species, which I found in rock-pools and on old *Fucus*-fronds, has been placed by Holmes and Batters provisionally in the genus *Urospora*, Aresch I am able to confirm this location of the species, for I found that it also produced tailed zoospores, although I was unable, owing to an insufficiency of material in the spore condition, to trace the life-history of these. The species had also been found by Carmichael at Appin.

**Chætomorpha linum**, Kütz.—A few filaments of this species were found in deep rock-pools near the Falls of Lora.

**Ch. tortuosa**, Kütz.—On *Corallina officinalis* near the Falls of Lora.

**Ch. litorea**, Holm. et Batt. (*Conferva litorea*, Phyc. Brit.).—Rare, in Loch Etive. "On sand and mud, Appin" (Carmichael).

**Ch. melagonium**, Kütz.—A few filaments of this large species were found in rock-pools in the Sound of Kerrara.

**Rhizoclonium riparium**, Harv.—"Appin" (Carmichael). Common in the district generally.

**Rh. arenosum**, Kütz. — "On sand, Appin" (Carmichael).

**Cladophora rupestris**, Kütz.—Abundant on rocks, *passim*.

**C. utriculosa**, Kütz., var **lætevirens**, Hauck. (*Cladophora lætevirens*, Phyc. Brit.).—Abundant in Loch Etive.

**C. lanosa**, Kütz., var. **uncialis**, Thur.—On *Polyides rotundus* from islands near Lismore.

**C. arcta**, Kütz.—Fairly common at Ardchattan and elsewhere.

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* *Revised List of the Marine Algæ of the L. M. B. C. District*, in *Trans. Biol. Soc., Liverpool*, vol. v.

### Cohort III.—SIPHONINÆ.

#### Order III.—VAUCHERIACEÆ.

**Vaucheria Thuretii**, Woron.—"Mud, Appin" (Carmichael).

**V. dichotoma** Lyngb., var. **marina**, C. Ag.—"On *Furcellaria*, Appin" (Carmichael).

I found filaments of *Vaucheria* in several situations, but was unable to determine the species owing to absence of reproductive organs.

## Series III.—*PHÆOPHYCEÆ*

### Cohort I.—ECTOCARPINÆ.

#### Order I.—DESMARESTIACEÆ.

**Desmarestia viridis**, Lamx.—Occasionally in dredgings in the Bay opposite Ardchattan Church, Loch Etive.

**D. aculeata**, Lamx.—Common in the district generally.

#### Order II.—DICTYOSIPHONACEÆ.

**Dictyosiphon fœniculaceus**, Grev.—One of the commonest of Phæophyceæ in the district.

#### Order III—PUNCTARIACEÆ

**Litosiphon pusillus**, Harv.—Abundant on old fronds of *Chorda filum, passim.*

**Striaria attenuata**, Grev.—"At low water, Appin" (Carmichael) A few fronds of this species came up in one of the dredge hauls, but they were without sporangia.

**Punctaria plantaginea**, Grev. — Common on various situations in the district.

**P. latifolia**, Grev., var. **zosteræ**, Le Jol. (*P. tenuissima*, Phyc. Brit.).—Rarely in Loch Etive.

#### Order IV.—ASPEROCOCCACEÆ.

**Myriotricha clavæformis**, Harv., var. **filiformis**, Farl.—Fairly common in various algæ.

**Asperococcus echinatus**, Grev.—Common, and often accompanied by the variety *vermicularis*,

Griff. I confess I do not see sufficiently distinct marks in the variety to warrant its separation from the typical form of Greville.

**A. bullosus**, Lamx. (*A. Turneri*, Phyc. Brit.).—"Appin" (Carmichael).

Order V.—ECTOCARPACEÆ.

**Ectocarpus terminalis**, Kütz. — Growing on several of the smaller brown and green algæ, Loch Etive. Specimens which I collected at Puffin Island, Anglesea, were named for me by Mr. E. A. L. Batters, and the plants I found in Loch Etive agree in all particulars with these.

**E. confervoides**, Le Jol., var. **siliculosus**, Kjellm. —Very common in the district.

**E. granulosus**, C. Ag.—In some rock-pools near the Falls of Lora, and cast ashore on islands in the Firth of Lorne.

**E. crinitus**, Carm —"On muddy shores, Appin" (Carmichael).

**E. distortus**, Harv.—"On *Zostera*, Appin" (Carmichael).

I failed to find either of these species, although I looked carefully for them in likely situations both at Appin and elsewhere.

**Isthmoplea sphærophora**, Kjellm. (*Ectocarpus sphærophorus*, Phyc. Brit.).—"On *Cladophora rupestris*, Appin" (Carmichael). Fairly common on *Plumaria elegans*, wherever that plant occurred.

**Pylaiella litoralis**, Kjellm. (*Ectocarpus litoralis*, Phyc. Brit.).—Very common on *Fucus*, *passim*.

Order VI.—ARTHROCLADIACEÆ.

**Arthrocladia villosa**, Duby. — "Appin" (Carmichael). This plant is no doubt not uncommon. I obtained several fragments in dredgings taken the day before I left Oban, and had no opportunity of searching more carefully for it.

Order VII —ELACHISTACEÆ.

**Elachista fucicola**, Fries.—Very common on *Fucus serratus*, passim.

### Order VIII.—Sphacelariaceæ.

**Sphacelaria radicans**, Harv.—"Sandy rocks, Appin" (Carmichael).—On sandy shore near the islands in Ardchattan Bay.

**S. cirrhosa**, C. Ag.—Very common, *passim* on various algæ.

**Chætopteris plumosa**, Kütz.—On islands in the Firth of Lorne, not uncommon.

**Cladostephus spongiosus**, C. Ag.—In sandy bays near North Connel.

**Halopteris filicina**, Kütz. (*Sphacelaria filicina*, Phyc. Brit.).—I found this species once only, on the shores of Eilan Dubh, a small island opposite Lismore.

### Order IX.—Myrionemaceæ.

**Myrionema strangulans**, Grev., var. **punctiformis** (*M. punctiforme*, Phyc. Brit.).—A common epiphytic on *Ceramium*, etc., in Loch Etive.

**Ralfsia clavata**, Crn. (*Myrionema clavatum*, Phyc. Brit.).—"On *Chrysemenia clavellosa*, at Appin" (Carmichael). This rare species, now identified as a *Ralfsia*, is, according to Mr. Batters, doubtfully synonymous with Carmichael's *Linckia clavata*.

**R. verrucosa**, Aresch. (*R. deusta*, Phyc. Brit.).—On Rocks near Dunstaffnage, occasionally.

### Order X.—Chordariaceæ.

**Stilophora rhizodes**, J. Ag.—Dredged in Loch Etive. I only obtained a stunted fragment, with sporangia however, which I identified from a similarly imperfect specimen named for me by Mr. Batters, and obtained at Puffin Island, Anglesea.

**Chordaria flagelliformis**, C. Ag.—Exceedingly common in Loch Etive, and in the Firth of Lorne.

**Mesoglœa vermiculata**, Le Jol.—On rocks near Dunstaffnage, and on islands near Lismore.

**Leathesia difformis**, Aresch. (*L. tuberiformis*, Phyc. Brit.).—On rocks near the Falls of Lora, rare.

## Cohort II.—Laminarinæ.

### Order I.—Scytosiphonaceæ.

**Scytosiphon lomentarius**, J. Ag. (*Chorda lomentaria*, Phyc. Brit.).—Fairly common on the shores of islands in the Firth of Lorne and in Loch Etive.

**Phyllitis fascia**, Kütz. (*Laminaria fascia*, Phyc. Brit.).—Occasionally in Loch Etive.

### Order II.—Chordaceæ.

**Chorda filum**, Stackh.—Very common on the coast generally.

### Order III —Laminariaceæ.

**Laminaria saccharina**, Lamx.—Common, *passim*.

**L. saccharina**, var. **phyllitis**, Le Jol. (*L. phyllitis*, Phyc. Brit.).—On rocks near the Falls of Lora.

**L. digitata**, Edm.

**L. hyperborea**, Foslie.

Both these species are exposed at low tide, and are generally distributed.

## Cohort V.—Fucinæ.

### Order I.—Fucaceæ.

**Fucus vesiculosus**, Linn.—I obtained not only the common form, but also var. *baltica*, J. Ag., on islands in the Firth of Lorne. The type species is of course ubiquitous.

**F. serratus**, Linn.—The type form is abundant everywhere, and the var. *latifolia*, Turn., occasionally occurs at low water-mark.

**F. platycarpus**, Thur.

**F. ceranoides**, Linn.

**Ascophyllum nodosum**, Stackh.

**Pelvetia canaliculata**, Decne. et Thur.

All these four species are fairly common on the coast generally.

The common mussel (*Mytilus edulis*) has a peculiar distribution in Loch Etive; it is invariably found firmly attached to the roots of *Ascophyllum nodosum*. I never found it anywhere else in the district, either free on rocks or at the root-discs of *Fucus*.

**Halidrys siliquosa**, Lyngb.—Very common on the shores of Loch Etive and Loch Creran.

### Cohort VII.—Dictyotinæ.

### Order I.—Dictyotaceæ.

**Dictyota dichotoma**, Lamx., var. **inflexa**, J. Ag.—Fairly abundant in rock-pools on the shores of Loch Etive, and on islands in the Firth of Lorne.

## Series IV.—*RHODOPHYCEÆ.*

### Cohort I—Porphyrinæ.

### Order I.—Porphyraceæ.

**Goniotrichum elegans**, Le Jol. (*Bangia elegans*, Phyc. Brit.).—I obtained specimens of a minute filamentous red alga opposite the Black Crofts, Loch Etive, which agree in all respects with the description given in the *Phycologia Britannica*, and with Le Jolis' diagnosis.

**Bangia fuscopurpurea**, Lyngb.—Fairly common at various situations on the coast.

**Porphyra ciliaris**, Crn. (*Bangia ciliaris*, Phyc. Brit.).—"On *Zostera*, Appin" (Carmichael).

**P. laciniata**, C. Ag.—This species was plentiful both in Loch Etive and on the islets in the Firth of Lorne.

**Erythrotrichia carnea**, J. Ag. (*Bangia ceramicola*, Phyc. Brit.).—"On other algæ, Appin" (Carmichael).

### Cohort II.—Nemalioninæ.

### Order I.—Helminthocladiaceæ.

### Tribe I.—Chantransieæ.

**Chantransia Daviesii**, Thur. (*Callithamnion Daviesii*, Phyc. Brit.).

**Ch. virgatula**, Thur. (*Callithamnion virgatulum*, Phyc. Brit.).

Both these species are common on other algæ in Loch Etive and Loch Creran.

**Ch. secundata**, Thur.—On *Cladophora rupestris* on islets near Lismore.

Tribe II.—**Nemalieæ.**

**Helminthora divaricata**, J. Ag. (*Dudresnaya divaricata*, Phyc. Brit.).—"At Appin, low water" (Carmichael).

Order III.—GELIDIACEÆ.

**Gelidium corneum**, Lamx.—Several varieties of this variable plant were collected in Loch Etive, but I had not the means of determining them at the time.

Cohort III.—GIGARTININÆ.

Order I.—GIGARTINACEÆ.

Tribe I.—**Gigartineæ.**

**Chondrus crispus**, J. Ag.—Exceedingly common, *passim.*

**Gigartina mammillosa**, J. Ag.—Common in Loch Etive, and especially so in Loch Creran.

Tribe II.—**Tylocarpeæ.**

**Phyllophora rubens**, Grev.—Loch Etive, Loch Creran, and islets off Lismore.

**Ph. membranifolia**, J. Ag.—Common in Loch Etive and in the Sound of Kerrara.

**Ahnfeltia plicata**, Fries. (*Gymnogongrus plicatus*, Phyc. Brit.).—This plant, which, so far as its reproductive organs are concerned, has long been a puzzle to phycologists, I found in large quantities in all the dredgings, and thrown up on the shores of the islets off Lismore. I thus obtained a large amount of material which, in addition to material kindly supplied to me by Profs. D. H. Scott, T. Johnson, and Farlow, will I hope enable me to publish shortly a detailed account of its vegetative structure and reproductive organs.

Order II.—RHODOPHYLLIDACEÆ.

Tribe I.—**Cystoclonieæ.**

**Cystoclonium purpurascens**, Kütz. (*Hypnæa purpurascens*, Phyc. Brit.).—Exceedingly abundant and very large in all dredgings.

**Catenella opuntia**, Grev.—On rocks near high water-mark at Dunstaffnage. Some specimens bore cystocarps, a detailed account of which, made on material collected in 1890 at Puffin Island, Anglesea, will be found in the *Journal of the Linnean Society* (*Botany*). I may mention as a curious fact that almost every collection I have made of *Catenella opuntia* at Anglesea, the Isle of Man, and on the West Coast of Scotland, has provided me with specimens in fruit. I think this the more remarkable, as the cystocarpia had, until I found them in 1890, been considered one of the great curiosities in the Rhodophyceæ.

### Tribe II.—**Rhodophyllideæ.**

**Rhodophyllis bifida**, Kütz. (*Rhodymenia bifida*, Phyc. Brit.).—A few specimens were obtained on islets off Lismore.

### Cohort IV.—RHODYMENINÆ.

### Order I.—SPHÆROCOCCACEÆ.

**Gracilaria confervoides**, Grev.—Fairly common in Loch Etive.

**Calliblepharis ciliata**, Kütz. (*Rhodymenia ciliata*, Phyc. Brit.).—In dredgings in Loch Etive.

### Order II.—RHODYMENIACEÆ.

**Rhodymenia palmata**, Grev.—This plant is very common all along the coast. Two very large specimens were obtained by my assistant, Mr. A. J. Ewart, in Loch Etive. The fronds of one of these measured 9 inches in breadth and 2½ feet in length. Dr. Scott informs me that these are the largest specimens he has seen of the species.

**Lomentaria articulata**, Lyngb. (*Chylocladia articulata*, Phyc. Brit.).—In Loch Creran, and on islets off Lismore.

**Chylocladia ovalis**, Hook.—Rare, near Dunstaffnage.

**Plocamium coccineum**, Lyngb.—Both var. *latifrons*,

Le Jol., and var. *uncinata*, C. Ag., the latter the more abundant, were collected from Loch Etive.

### Order III.—Delesseriaceæ.

#### Tribe I.—Nitophylleæ.

**Nitophyllum laceratum**, Grev.

**N. punctatum**, Grev.

Both these species were found on islets off Lismore.

#### Tribe II.—Delesserieæ.

**Delesseria alata**, Lamx.

**D. sinuosa**, Lamx.

**D. sanguinea**, Lamx.

These three species were fairly common in almost all localities where a search was made for them.

### Order V.—Rhodomelaceæ.

**Rhodomela subfusca**, C. Ag.,—Loch Etive and Loch Creran.

**Odonthalia dentata**, Lyngb.—Very abundant and large in Loch Etive and the Firth of Lorne.

**Laurencia pinnatifida**, Lamx.—Not common, but generally distributed on rocky parts of the coast.

**L. obtusa**, Lamx., var. **genuina**, Hauck.—Loch Etive, in rock-pools near Falls of Lora.

**Lophothalia byssoides**, J. Ag. — Common in dredgings from Loch Etive.

**Polysiphonia urceolata**, Grev. — Very common, *passim*.

**P. nigrescens**, Grev.—Very common, *passim*.

**P. elongata**, Grev.—On islets in Firth of Lorne, and at Achnacree, Loch Etive.

**P. fibrata**, Harv.—Occasionally in Loch Etive.

**P. spinulosa**, Grev.—The type form and var. *major* are both recorded from Appin by Carmichael.

**Dasya coccinea**, C. Ag.—Abundant and very large on the coast generally.

### Order VI.—Ceramiaceæ.

**Spermothamnion Turneri**, Aresch., var. **repens**, Le Jol.—On *Cladostephus* in Loch Etive.

**Ptilothamnion pluma,** Thur. (*Callithamnion pluma,* Phyc. Brit.).—"On *Laminaria hyperborea* at Appin" (Carmichael).

**Griffithsia setacea,** C. Ag.—Common on islets off Lismore, at low water.

**Pleonosporium Borreri,** Näg.—One specimen was obtained from a rock-pool at low water, near the Falls of Lora.

**Rhodochorton Rothii,** Näg.

**Rh. floridulum,** Näg.

**Rh. membranaceum,** Magn.

All three species are common in the district.

**Rh. sparsum,** Kjellm. (*Callithamnion sparsum,* Phyc. Brit.).—"Appin" (Carmichael).

**Rh. mesocarpum,** Kjellm. (*Callithamnion mesocarpum,* Phyc. Brit.).—"Appin" (Carmichael).

**Callithamnion Hookeri,** C. Ag.

**C. corymbosum,** Lyngb.

I was rather astonished at the paucity of Callithamnions on the coast; these two species were the only forms I saw.

**Plumaria elegans,** Bonnem.

**Ptilota plumosa,** G. Ag.

Both common forms in Loch Etive and elsewhere.

**Ceramium strictum,** Harv.—I am doubtful about the identification of this species, of which I found only one plant.

**C. rubrum,** C. Ag.—Abundant and variable as usual.

**C. acanthonotum,** Carm.—Occasionally at low water near Dunstaffnage.

**C. Deslongchampsii,** Chauv.—Fairly common in Loch Creran and on islets off Lismore.

### Cohort V.—CRYPTONEMINÆ.

#### Order I.—GLŒOSIPHONIACEÆ.

**Glœosiphonia capillaris,** Carm.—"Appin, low water" (Carmichael). Loch Etive, opposite Achnacree.

### Order III.—DUMONTIACEÆ.

**Dumontia filiformis**, Grev.—Very common all along the coast.

**Dilsea edulis**, Stackh.—Common on islets off Lismore.

### Order IV.—NEMASTOMACEÆ.

**Furcellaria fastigiata**, Lamx.—Common on all sandy parts of the coast.

### Order V.—RHIZOPHYLLIDACEÆ.

**Polyides rotundus**, C. Ag.—Occasionally on rocks in Loch Etive.

### Order VI.—SQUAMARIACEÆ.

**Petrocelis cruenta**, J. Ag.—"Appin" (Carmichael). On rocks on islets off Lismore.

### Order VII.—HILDEBRANDTIACEÆ.

**Hildebrandtia prototypus**, Nardo., var. **rosea**, Kütz. (*H. rosea*, Phyc. Brit.).—On rocks at North Connel.

### Order VIII.—CORALLINACEÆ.

**Corallina officinalis**, Linn.—This species, so common on many parts of the shores of Great Britain, is scarce in the Oban district, and very dwarf even where it does occur.

**C. rubens**, Ellis et Sol.—At Lismore.

**Melobesia membranacea**, Lamx.—Common on rocks at various localities.

**Lithothamnion polymorphum**, Aresch. (*Melobesia polymorpha*, Phyc. Brit.).—Very common on rocks, *passim*.

## XXIII.

# *LIST OF FORAMINIFERA DREDGED IN PORTREE BAY, ISLAND OF SKYE.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

[Read 26th November, 1889.]

On a former occasion I directed the attention of the Society to some Foraminifera new to Britain, which had been dredged during the month of August, 1879, in Portree Bay, at a depth of from 14 to 18 fathoms, where the bottom consisted of mud, shells, and gravel.* The following list contains the result of two hauls, made close together in Portree Bay, with a little dredge measuring 9 by 5 inches, under conditions as to depth and sea-bottom similar to those above mentioned. Only a small portion of the material was examined, yet the great number of species obtained, amounting to over 100, shows the richness of the locality.

*Biloculina depressa*, d'Orb.—Common.
*ringens*, Lamk. „
*elongata*, d'Orb. „
*irregularis*, d'Orb.—Frequent.
*Spiroloculina limbata*, d'Orb. „
*canaliculata*, d'Orb.—Common.
*excavata*, d'Orb.—Frequent.
*Miliolina trigonula*, Lamk.—Common.
*tricarinata*, d'Orb. „
*oblonga*, d'Orb.—Frequent.
*secans*, d'Orb.—Rare.
*bicornis*, Walker and Jacob.—Rare.
*seminulum*, Linn.—Common.
*tenuis*, Czjzek.—Common.

* *Proceed. Nat. Hist. Soc. Glasg.*, vol. v., p. 11.

*Miliolina candicans*, d'Orb.—Frequent.
*fusca*, Brady.—Common.
*contorta*, d'Orb.—Rare.
*subrotunda*, Montagu.—Rare.
*Planispirina celata*, Costa.—Rare.
*Cornuspira foliacea*, Phil.—Frequent.
*Psammosphæra fusca*, Schultze.—Rare.
*Jaculella acuta*, Brady.—Not common.
*Hyperammina elongata*, Brady.—Rare.
*Reophax difflugiformis*, Brady.—Not common.
*scorpiurus*, Montfort.—Common.
*nodulosa*, Brady.—Frequent.
*Haplophragmium glomeratum*, Brady.—Common.
*pseudospirale*, Willm. „
*canariense*, d'Orb.—Frequent.
*Ammodiscus incertus*, d'Orb. „
*gordialis*, Jones and Parker. „
*Trochammina squamata*, Jones and Parker.—Rare.
*inflata*, Montagu.—Rare.
var. *macrescens*, Brady.—Frequent.
*robertsoni*, Brady.—Common.
*Textularia sagittula*, Defrance.—Frequent.
*variabilis*, d'Orb. „
*gibbosa*, d'Orb.—Not common.
*Bigenerina digitata*, d'Orb.—Frequent.
*Gaudryina filiformis*, Berthelin. „
*Verneuilina polystropha*, Reuss.—Common.
*Valvulina fusca*, Willm.—Rare.
*Bulimina marginata*, d'Orb.—Frequent.
*pupoides*, d'Orb. „
*aculeata*, d'Orb. „
*ovata*, d'Orb.—Common.
*subteres*, Brady.—Frequent.
*Virgulina schreibersiana*, Czjzek.—Common.
*Bolivina punctata*, d'Orb.—Not common.
*costata*, d'Orb.—Common.
*dilatata*, Reuss.—Frequent.
*plicata*, d'Orb.—Not common.
*Cassidulina lævigata*, d'Orb.—Not common.
*Lagena lævis*, Montagu. „ „

*Lagena williamsoni*, Alcock.—Common.
*striata*, d'Orb. "
" An apiculate form.—Common.
*semistriata*, Williamson. "
*apiculata*, Reuss.—Rare.
*haidingera*, Czjzek.—Common.
*hispida*, Reuss.—Rare.
*gracillima*, Seguenza.—Common.
*distoma*, Parker and Jones.—Not common.
*clavata*, d'Orb. " "
*lævigata*, Reuss. " "
*orbignyana*, Seguenza.—Common.
*lucida*, Williamson. "
*globosa*, Montagu.—Not common.
*squamosa*, Montagu.—Common.
*hexagona*, Williamson. "
*Nodosaria (Glandulina) lævigata*, d'Orb.—Rare.
*scalaris*, Batsch.—Common.
*pyrula*, d'Orb. "
*obliqua*, d'Orb.—Rare.
*communis*, d'Orb.—Common.
*consobrina*, d'Orb.—Rare.
*pauperata*, d'Orb.—Common.
*Marginulina glabra*, d'Orb.—Rare.
*Cristellaria crepidula*, Fichtel and Moll.—Not com.
*rotulata*, Lamk.—Frequent.
*Amphicoryne falx*, Jones and Parker.—Rare.
*Polymorphina compressa*, d'Orb.—Common.
" A fistulose form.—Rare.
*myristiformis*, Williamson.—Rare.
*oblonga*, Williamson. "
*gibba*, d'Orb. "
*Uvigerina pygmæa*, d'Orb.—Frequent.
*angulosa*, Williamson.—Common.
*Globigerina bulloides*, d'Orb.—Frequent.
*Orbulina universa*, d'Orb.—Common.
*Patellina corrugata*, Williamson.—Rare.
*Discorbina rosacea*, d'Orb.—Frequent.
*wrightii*, Brady (= *obtusa*, d'Orb.)—Freq.
*Planorbulina mediterranensis*, d'Orb.—Not common.

*Truncatulina lobatula,* Walker and Jacob.—Freq.
*ungeriana,* d'Orb.—Rare.
*variabilis,* d'Orb. „
*Pulvinulina auricula,* Fichtel and Moll.—Frequent.
*Rotalia beccarii,* Linn.—Frequent.
*nitida,* Williamson. „
*Gypsina inhœrens,* Schultze.—Rare.
*Nonionina depressula,* Walker and Jacob.—Common.
*umbilicatula,* Montagu. „
*turgida,* Williamson.—Frequent.
*Polystomella crispa,* Linn.—Not common.
*striatopunctata,* Fichtel and Moll.—Com.
*Operculina ammonoides,* Gronovius.—Frequent.

XXIV.

# *LIST OF SHELLS, ETC., OBSERVED ON THE ARDEER AND IRVINE BEACHES, AYRSHIRE.*

BY JOHN SMITH.

[Read 21st April, 1891.]

THE district between Saltcoats and Barassie includes the Ardeer and Irvine shores, which form a continuous coast-line extending to 6½ miles in length, and composed entirely of sand. It is bounded on the Saltcoats side by rocks of Upper Carboniferous age and their associated traps, which latter have been the means of protecting from the inroads of the sea the area upon which the town of Saltcoats is built. At Barassie, on the southern side, a mass of trap rock takes the place of the sand. With the exception of the Lappock, an islet laid bare at low tide and situated in the bay 1½ miles north-west of Barassie, no rocks rise above low-water in the offing opposite this part of the coast. The tide retires here for a considerable distance, leaving a long flat expanse of sand without any mud or gravel-banks. All along the shore, and for some distance inland, are banks and hills of drifted sand, rising at one part to a height of about 90 feet. These sand-hills or dunes have been accumulated partly by the sand blown up from the shore, but probably to a greater extent by the aerial deformation of the old raised beaches. It is scarcely to be credited (unless one is an eye-witness to the fact, as I have many times been) that in rough weather, and even in the midst of heavy driving showers, the sand continues to drift from the beach and is whirled up on the dunes. These, from the prevailing south-west winds, are

yearly gaining a small advance on the land to the north-east, but are prevented from making greater inroads by the growth of *Ammophila arundinacea, Carex arenaria, Salix repens,* and a number of other plants. During the raised-beach period the sea encroached on the lower-lying land in this district of Ayrshire to the extent of about 14 square miles; and such of this land as is not now occupied by drifting sand is either laid down in permanent pasture of a very poor quality, or, if cultivated, consists of a very sandy soil which, as the farmers forcibly put it, will "worry up any quantity of manure." Large quantities of sea-weed are cast ashore after a storm, and many hundred tons are annually collected by the farmers for use as manure. There are differences of opinion amongst farmers as to its qualities as a fertiliser; but there can be little doubt that if the farmers would first utilise it as fuel, as is done in the Channel Islands, they would find in the rich ashes an excellent manure much superior to a great deal of the artificial material which is supplied to them. The great bulk of the sea-weed cast ashore consists of *Laminaria, Fucus,* and *Halidrys,* as well as the marine flowering plant *Zostera.*

In early winter, at least 70 per cent. of the *Laminaria digitata* has a subconical hollow eaten into the lower part of the stem by the little gastropod *Helcion pellucidum,* the stems having been broken away just at this part; but much of the *Laminaria* is also cast up with the roots entire, and bearing with them stones of a considerable size as well as quantities of gravel. It is probable, indeed, that any stones and gravel existing on this shore may have been brought hither by the sea-weeds, presumably from some old beach that was formed when the land stood somewhat higher than at present. The leaves of *Zostera marina* are often rolled together into small wisp-like masses. To many of the sea-weeds are attached various species of *Polyzoa,* and

some of them are thickly covered with *Spirorbis*, etc.

Various Fishes are occasionally cast up during storms, and this winter a small Shark (which, however, I did not see) was found on the Ardeer shore. The egg-cases of the Skate are sometimes obtained, and more rarely those of the Dogfish.

Among the Crustacea often cast ashore may be mentioned *Inachus dorsettensis, Hyas coarctatus, Cancer pagurus, Carcinus mœnas, Corystes cassivelaunus, Pagurus Bernhardus*, and *P. Prideauxii.* I have seen but rarely *Gonoplax angulata, Galathea squamifera*, and fragments of *Homarus vulgaris.* Various species of Cirripedia are often found attached to stones, and once I obtained a cluster of *Lepas anatifera.*

On three or four occasions I have got the sea-mouse, *Aphrodite aculeata*, with its brilliant array of iridescent spines. The lovely *Pectinaria belgica*, with its brilliant scarlet combs, and conical tube neatly built of grains of sand, is sometimes cast ashore in abundance; and the leathery sand-covered tubes of *Terebella* are also plentiful.

Among the Echinoderms may be mentioned *Amphidotus cordatus*, often strewn upon the shore in thousands; *Echinus sphœra, Ophiura albida, Asterias aurantiaca, Uraster rubens*, all frequently cast up; and *Solaster papposa*, occasionally obtained. Once I found a little red worm-like Holothurian whose skin was thickly studded with microscopic "anchors and plates."

Various Anemones occur, including *Adamsia palliata* frequently found attached to the mouth of a *Buccinum undatum* in which the hermit-crab *Pagurus Prideauxii* has taken up its abode. Sponges, including several species of *Halichondria*, as well as the boring *Clionœ*, are often met with.

The following Shells have been collected from the Ardeer and Irvine Beaches during a period of about twenty years:

*Anomia ephippium*, Linn.—Common; fixed to other shells, sea-weeds, crabs, etc.

*Ostrea edulis*, Linn.—Frequent, but never with animal.

*Pecten opercularis*, Linn.—Scarce.

*varius*, Linn.—Very rare.

*maximus*, Linn.—Scarce.

*Mytilus edulis*, Linn.—Frequent.

*modiolus*, Linn.—Rare.

*Pectunculus glycymeris*, Linn.—Rare.

*Lucina borealis*, Linn.—Rare.

*Cardium echinatum*, Linn.—Frequent, but never with animal.

*edule*, Linn.—Frequent.

*norvegicum*, Speng.—Frequent.

*Cyprina islandica*, Linn.—Frequent as single valves brought ashore by sea-weeds. It may possibly come from a glacial bed, but I do not think so, never having found a truly boreal shell on this beach.*

*Venus exoleta*, Linn.—Frequent.

*lincta*, Pult.—Frequent.

*fasciata*, Da Costa.—Rare.

*verrucosa*, Linn.—Rare.

*gallina*, Linn.—Common.

*Tapes aureus*, Gmel.—Rare.

*virgineus*, Linn.—Rare.

*pullastra*, Mont.—Scarce.

*decussatus*, Linn.—Scarce.

*Tellina crassa*, Gmel.—Rare.

*balthica*, Linn.—One shell.

*tenuis*, Da Costa.—Abundant.

*fabula*, Gron.—Common.

*Psammobia ferröensis*, Chemn.—Scarce.

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* Since the above was written, a small shell of this species, containing the animal has been cast ashore.

NOTE.—This last winter (1891-92.) I have got a valve of *Astarte borealis*, and one of *Pecten islandicus*; but both have probably been washed out of some clay dug up when the gasometer last erected at Troon was being founded. This clay contained other Arctic shells.

*Donax vittatus*, Da Costa.—Frequent.
*Mactra subtruncata*, Da Costa.—Abundant.
*stultorum*, Linn.—Frequent.
*Lutraria elliptica*, Lam.—Frequent.
*Scrobicularia piperita*, Bellonius.—Scarce.
*Solen ensis*, Linn.—Common.
*siliqua*, Linn.—Common.
*Thracia papyracea*, Poli.—Scarce.
*Mya arenaria*, Linn.—Frequent; shells only.
*truncata*, Linn.—Rare; shells only.
*Saxicava rugosa*, Linn.—Common amongst the roots of *Laminaria*, in holes in stones, and on timber.
*Pholas crispata*, Linn.—Rare.
*Xylophaga dorsalis*, Turton.—Frequent in pieces of wood and timber.
*Teredo*.—Several species in pieces of timber.
*Patella vulgata*, Linn.—Common.
*Tectura virginea*, Müll.—Rare.
*Helcion pellucidum*, Linn.—Frequent in cavities which it has eaten in the lower part of the stem of *Laminaria digitata*.
*Puncturella Noachina*, Linn.—Rare.
*Emarginula fissura*, Linn.—Rare.
*Trochus magus*, Linn.—Frequent, but never with animal.
*tumidus*, Montagu.—Frequent.
*cinerarius*, Linn.—Frequent.
*umbilicatus*, Mont.—Frequent.
*zizyphinus*, Linn.—Scarce.
*Lacuna divaricata*, Fabr.—Scarce.
*pallidula*, Da Costa.—Scarce.
sp.—Worn specimens.
*Littorina obtusata*, Linn. Common.
*littorea*, Linn.—Common.
*rudis*, Maton.—Frequent.
*Rissoa parva*, Da Costa.—Frequent.
var. *interrupta*, Ad.—Frequent.
*Homalogyra atomus*, Phil.—Scarce.

*Cæcum glabrum*, Mont.—Scarce.
*Turritella terebra*, Linn.—Rare.
*Scalaria communis*, Lam.—Rare.
*Turtonæ*, Turt.—Rare.
*Eulima* sp.—Rare; worn specimens.
*Natica sordida*, Phil.—Rare.
*catena*, Da Costa.—Common.
*Alderi*, Forbes.—Common.
*Velutina lævigata*, Penn.—Scarce.
*Aporrhais Pes-pelecani*, Linn.—Rare.
*Cerithium reticulatum*, Da Costa.—Frequent.
*Purpura lapillus*, Linn.—Scarce; common enough on the rocks north and south of this area.
*Buccinum undatum*, Linn.—Large variety common.
*Fusus antiquus*, Linn.—Rare; empty.
*gracilis*, Da Costa.—Rare.
*Nassa reticulata*, Linn.—Frequent.
*Cypræa europæa*, Mont.—Rare.
*Utriculus obtusus*, Mont.—Frequent.
*truncatulus*, Brug.—Frequent.
*Actæon tornatilis*, Linn.—Scarce.
*Scaphander lignarius*, Linn.—Frequent.
*Sepia officinalis*, Linn.—Rare; internal bone only.

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NOTE.—Since writing the above, I have learned from the fishermen and others that at a distance of about a mile from the mouth of the Irvine Water the bed of the Firth suddenly deepens from about six to thirteen fathoms. This submarine cliff runs towards Troon, on the one hand, and in the direction of the west end of Stevenston, on the other. Since this agrees exactly with the direction of the "Capencraig Gaw," or trap-dyke which passes in a north-west and south-east direction near the west end of the town of Stevenston, I have no doubt that the sudden alteration in the depth of the sea-bed takes place against the side of this dyke; and it is not unlikely that at one time, when the land stood higher than at present, a line of shore cliffs stretched along for some distance at this part, the top of which is now only seen during low water at the Lappock Rock. This sudden break in the continuity of the sea-bed will no doubt have some influence on the shells that are washed ashore on this beach.—*J. S.*

XXV.

# *ON THE DISTRIBUTION OF* EQUISETUM MAXIMUM, *LAM., AND* E. HYEMALE, *LINN., THROUGHOUT AYRSHIRE.*

BY JOHN SMITH.

[Read 23rd February, 1892.]

## Equisetum maximum, *Lam.*

In the first edition of Hennedy's *Clydesdale Flora* the only station given for this plant is the Island of Arran; but in the *Fauna and Flora of the West of Scotland* two localities are added, viz., St. Germans and Wemyss Bay. I find it to be a widely distributed plant in Ayrshire, and a knowledge of its localities may be of interest to local students of botany.

1.—A few stunted plants occur in a wood on the south side of Kelly Burn (Parish of Largs) at the extreme northern end of the county.

2.—In Noddsdale, above Largs, there are two or three considerable patches, the plants being large and strong, and from three to four feet in height. For a knowledge of this locality I am indebted to our Secretary, Mr. Boyd.

3.—On the north side of the Doon Water (Parish of Ayr) at about a quarter to half a mile above the "Auld Brig," growing partly in a wood.

4.—Abundant on side of approach to Ardmillan House (Parish of Girvan), under the shade of trees.

5.—South of Lendalfoot (Parish of Colmonell); plants small, six to twelve inches high, growing in the open on very wet ground near the coast.

6.—In Cairnhill Woods (Parish of Craigie), near the side of Cessnock Water.

7.—Roadside plantation near Kirkmichael, growing partly in the hedgerow.

8.—Among trees on the side of south approach to Lanfine House, near Newmilns.

### Equisetum hyemale, *Linn.*

1.—Craigenconner Glen on Cessnock Water (Parish of Craigie); partly shaded by trees.

2.—Side of Ayr Water near Failford (Parish of Tarbolton).

3.—Cairnhill Woods (Parish of Craigie).

4.—In a wood at Wallacetown, near Lugar, on north side of Glenmuir Water (Parish of Auchinleck); partly shaded by trees.

In all the localities where *E. maximum* grows, it is always (except in the first station mentioned) in large patches. On the other hand, *E. hyemale* is represented by few but vigorous plants. The latter always occurs where the ground is moist; while the former grows equally on dry and wet soil, but becomes stunted in growth when exposed to too much or too little moisture. In the Lendalfoot locality, the sea air may probably have had as much influence as the wetness of the soil in checking the growth of the plants.

XXVI.

# *NOTES ON THE OCCURRENCE OF* LEDUM PALUSTRE, *L., IN STIRLINGSHIRE AND PERTHSHIRE.*

BY JOHNSTON SHEARER.

[Read 29th April, 1890.]

At a meeting of the Society held on 16th August, 1887, Professor Thomas King drew attention to the recent discovery, in the neighbourhood of Bridge of Allan, of *Ledum palustre*, L., a plant new to the Flora of Great Britain, and stated that its identity had been confirmed by Sir J. D. Hooker and the late Mr. James Ramsay.* As I was connected with this discovery—or rather re-discovery, for it appears that the *Ledum* is mentioned in an old guide-book to Bridge of Allan—and have learned some important particulars as to the distribution of the plant, a few notes on its history and identification may be of some interest to the Society.

*Ledum* is a genus of the Natural order *Ericaceæ*, and abounds in the Arctic Regions. The species possess narcotic properties, and an infusion of their leaves is used in North America as a substitute for tea, under the name of "Labrador Tea" or "James's Tea." Hooker has placed *L. palustre* amongst the excluded species in the Appendix to his *Flora of the British Isles*, with the remark: "N. W. Ireland, Giesecke; never confirmed." It has now, however, I am informed, been reinstated as a British plant; and I have now to confirm its claim to recognition as a Scottish species.

In the spring of 1879, the School Board of Bridge of Allan, where I resided, offered a prize to the

* *Proceedings*, vol. ii. (N.S.), p. xxxvi.

scholar who should make the best collection of wild-flowers during the summer; and Mr. Robert Geddes, shoemaker there, a man of considerable intelligence, resolved that his daughter should gain the prize. He accordingly went out with his children, and induced them to gather every plant which they saw to differ from another. He knew nothing about botany beyond the popular names of a few of the common flowers. I assisted him in naming them, and often went out with him in his excursions, showing him how to distinguish different species and varieties. As he had a keen eye, and had acquired a great liking for the work, he made a large and interesting collection. Among the plants brought to me was a piece of *Ledum*, which he told me he had found in Lecropt Moss. It was quite new to me, and in order to find out what it was I went to the moss and saw it growing amongst the heather in considerable quantity. It was not in flower, but the seed-vessels of the previous year were still visible. I took a piece of it to my friend the late Mr. Croall, President of the Stirling Field Club, of which I was a member, but he had never seen the plant before, and we spent an evening fruitlessly trying to identify it. We were inclined to think that it was an exotic which had somehow been introduced into the Moss. I afterwards gave Mr. Croall some plants for his garden. Soon after that I was called away to England, and had forgotten all about the "find" until five years later, when it was brought to my recollection by the receipt of a letter from Mr. Croall in which he wrote: "I was amused the other day by one of our doctors coming in, and, after unfolding a paper parcel, exhibiting a branch of *Ledum palustre*, informing me that an Edinburgh doctor had sent saying that he had been told it grew in abundance under the walls of Stirling Castle, and wished to have a quantity of it. I informed him that the nearest locality to Stirling Castle was my garden, and that its presence there

was due to Mr. Shearer, Bridge of Allan, who had discovered it in Blairdrummond Moss, and that a supply for medical purposes could only be got from the Arctic Regions." Mr. Croall was mistaken in describing the station where the plant was found as Blairdrummond Moss instead of Lecropt Moss; and that led to a similar error in the List of Plants given in Shearer's *Guide-Book to Stirling*, which was based upon the Catalogue of the Field Club compiled by Mr. Croall. My doubts, however, as to its claim to recognition as a British plant had the effect of cooling my interest in it, until the statement by Professor King, to which I have referred, appeared in our Society's *Proceedings*. I surmised that my old acquaintance, the shoemaker, had brought it under the notice of Sir J. D. Hooker; and having occasion to be at Bridge of Allan on business the other day, I called on Mr. Geddes, when he gave me some important information as to new stations which he had discovered for the *Ledum*, and also as to its identification by the botanical authorities.

Mr. Geddes had found it in flower after I had left Bridge of Allan, and its striking appearance made him anxious to learn its name. He accordingly sent a specimen to Sir Joseph Hooker, in the name of his daughter, as it was one of the plants in her school collection. The specimen was handed by Sir Joseph to Mr. Arthur Bennett, F.L.S., Croydon, by whom it was exhibited at a meeting of the Royal Botanical Society of London; and a vote of thanks to Miss Nellie Geddes was passed by the Society, and transmitted to her by Sir Joseph Hooker in a very kind letter. Mr. Geddes also showed the plant to the late Mr. James Ramsay, who was residing for some time at Bridge of Allan, and took him to the moss where it was growing, and Mr. Ramsay was satisfied that it must have been established there for a very long period.

Being anxious to get a specimen in flower, I went to the moss, accompanied by my friend, but the

flowers were only coming out; however, I brought away a branch for the purpose of exhibiting it at this meeting. We were much grieved to find the plant nearly extinct, four bushes being all we could find after a prolonged search. At the time of Mr. Ramsay's visit there were a great many plants; but since then the locality had been visited by the botanical class from Edinburgh University, under the guidance of a well-known local botanist, who had ruthlessly rooted up, as far as we could see, all but those four plants. Such wholesale and thoughtless destruction surely deserves the severest censure.

My concluding remarks are of a more agreeable character. Mr. Geddes informed me that he had found the *Ledum* growing in Blairdrummond Moss, which is on the west or opposite side of the River Teith from Lecropt Moss; and also that he had been told by a hawker who called at all the outlying farm-houses, and who had seen the plant in flower in Mr. Geddes' window, that there was plenty of it in the mosses up by way of Lake of Menteith. And about five weeks ago Mr. Geddes himself saw about half-a-dozen bushes of it in flower in Flanders Moss, between Buchlyvie and Gartmore. I sent him a map that he might mark the spot, and when returning it he writes: "I am told that the *Ledum* is found all through the Flanders Moss."

It is a remarkable circumstance that a plant so conspicuous when in flower should have remained undiscovered by botanists. I can only attribute this to its flowering at an earlier period of the year than that at which botanists visit the mosses; and when out of bloom it bears so much resemblance to the Bog Myrtle (*Myrica Gale*) and other bushes as to be easily overlooked.

The whole of the valley from Stirling to Gartmore has probably in remote times been one continuous moss, of which the isolated fragment of about two acres, where we first found the *Ledum*, is all that now remains in the Carse of Lecropt, and will at no very distant period disappear before the plough.

# XXVII.

# *ON THE NESTING HABITS OF THE KINGFISHER* (ALCEDO ISPIDA, *L.*).

BY ANDREW SCOBIE.

[Read 13th August, 1889.]

It is asserted by some writers that the Kingfisher, for the purpose of nesting, selects the hole of some burrowing Mammalia. For the last ten years I have paid particular attention to the habitat of this bird, and during that period have known eight nests. In all the eight instances the Kingfisher dug out its own burrow, the depth of which ranged from 24½ to 32½ inches, and the time taken for excavation was from 22 to 24 days.

It has also been said that the Kingfisher deposits its eggs on the bones of decayed fish. In all the eight instances referred to I found that the birds laid their eggs on the bare sand. During the season of incubation the male supplies the female with food, and after a time the lower part of the burrow gets well-filled with disgorged bones. After the young Kingfishers are four days old, they seem never to lie down, but stand erect with their bills pointed to the entrance of the hole. I have known seven young birds consume no less than eight dozen middle-sized minnows per day.

After the parent birds had been shot, I have had their eggs hatched in a robin's nest. The young birds are very easily reared in confinement.

In the moulting season the Kingfishers feed largely on moths and other insects, and during the last eight years I have watched them hawking moths, etc., in the autumn evenings.

## XXVIII.

# *ON THE MANUFACTURE OF PAPER FROM THE BARK OF TREES IN UPPER BURMAH.*

BY JOHNSTON SHEARER.

[Read 25th March, 1890.]

THE piece of paper now exhibited to the Society was made in the Shan Country of Upper Burmah. It was brought home by a military officer whose regiment formed part of the South Shan expedition, sent to explore our newly acquired territory, and bring the wild native tribes into subjection to British rule. The country is superior to India in its natural productions, but is so remote and inaccessible from the great ranges of hills intersecting it, and the want of roads for wheeled vehicles, that the Europeans of the expedition were the first white men who were ever known to have visited it.

This paper, notwithstanding its thinness and rough appearance, is the common writing-paper of the country. It is surprising how easily the pen or pencil goes over it, and its remarkable strength makes it an article of great use to the native people for many purposes to which our common paper could not be applied.

The following notes on the way in which the paper is made are extracted from the journal of the gentleman who brought home the specimen, and who saw the processes in operation.

It is made from the inner bark of a tree, long strips of which are soaked in vats having a fire under them. The vats are sunk in a small terrace cut in the side of a hill, the mouths being level

with the top of the terrace. An arched hole is then dug into the face of the ground below each vat where the fire is placed. When the strips are sufficiently softened, a quantity enough for one sheet of paper at a time is taken and well beaten by a woman with a wooden mallet in each hand. After having been turned about and beaten for some time, the pulp, to which the strips are now reduced, is put into a bamboo-joint four or five inches in diameter, nearly full of water, and the fibre is thoroughly disintegrated by rapidly working up and down in it a stick about a foot long, having little cross-pins at the bottom end like the plunger of an old-fashioned churn. When this is completed—which is the work of about a minute—a wooden frame, with muslin tightly stretched over it, is laid on a shallow tray about an inch deep full of water, and the contents of the bamboo are poured into it. The pulp settles on the muslin, its even distribution being obtained by tapping the cloth with the fingers. The frame is then gently lifted out of the tray, and the water allowed to drain away. There is now a fairly even layer of wet pulp upon the frame, which is put in the sunshine to dry. Afterwards the paper is stripped off the cloth, its detachment being assisted when necessary by an instrument like a large clumsy paper-knife. It requires no sizing, and is ready for use.

# XXIX.

# *NOTES ON* GASTEROPTERON MECKELII, *KOSSE.*

BY EDGAR A. SMITH, F.Z.S.

[Read 29th April, 1890.]

THE Rev. J. E. Somerville, B.D., has recently presented to the British Museum a specimen of *Gasteropteron Meckelii*, which he dredged a short time since at Mentone in 30 fathoms. This is especially valuable to the Museum, being the first example of this mollusk in the collection.

This remarkable Tectibranchiate Mollusk occurs in various parts of the Mediterranean, and has not yet been discovered beyond that region. It is usually found on sandy bottoms at a depth of from 20 to 30 fathoms, although occasionally it affects shallower water. It has also been asserted that it has the power of floating at the surface. Its food appears to consist of Foraminifera and the larval forms of various invertebrate organisms. It progresses by a flapping movement of the lateral pedal lobes, instead of crawling like most other gastropods. These lobes of the foot recall to mind the appearance of certain Pteropods, and this resemblance induced early naturalists to associate *Gasteropteron* with that class.

In a living state the body and foot-lobes of this curious animal are of a vivid red or orange-red colour, the lobes being usually marked beneath with a few scattered white spots and ornamented with a pale or bluish border. The head is somewhat triangular, obtuse in front and pointed behind, and exhibits no trace of eyes or tentacles. Although no

eyes are visible externally, the animal probably can see to some extent, for visual organs exist, although beneath the outer skin. The branchial plume is exposed on the right side of the back, and the posterior extremity of the mantle terminates in a short bright-red tentacular process, the precise function of which is not at present understood.

*Gasteropteron* is provided with a minute internal shell. It is only about one-fiftieth of an inch in diameter, excessively thin, shaped like a *Nautilus*, and protects a minute spiral lobe of the liver.

This animal was originally described by Kosse in 1813. It was subsequently investigated by Delle Chiaje, Cantraine, Souleyet, and Krohn, and finally a full anatomical account by Vayssière appeared in the *Annales des Sciences naturelles*, vol. ix. (1879-80).

XXX.

# *BOTANICAL NOTES FROM WIGTOWNSHIRE, KIRKCUDBRIGHTSHIRE, AND DUMFRIES-SHIRE IN 1890.*

BY JAMES M'ANDREW.

[Read 25th November, 1890.]

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## Wigtownshire.

In July, 1890, the Rev. James Gorrie, Free Church Manse, Sorbie, and I added to the Flora of Wigtownshire the following plants denoted by an asterisk:

In Capenoch Moss, near Whauphill, we gathered **Drosera intermedia*; a **Utricularia,* which, if found in flower, may turn out to be *U. Bremii*; **Scirpus fluitans*; **Carex Œderi,* Ehrh.; and **Selaginella selaginoides.* Near Sorbie village we found **Ranunculus bulbosus, *Erophila vulgaris,* and **Habenaria bifolia.* At Dowalton Loch (drained) we gathered **Utricularia vulgaris, *Polypodium Dryopteris, *Lycopodium Selago,* and **Nitella opaca*; and we saw growing at the farm of Stonehouse the following ferns which had been taken from the same loch: **Polypodium Phegopteris, *Polystichum aculeatum, *P. lobatum,* and **Cystopteris fragilis.* At White Loch, Ravenstone, we got **Radiola Millegrana.* In addition to the above, Mr. Gorrie has found **Saxifraga granulata* in the grounds of Galloway House, and **Hyoscyamus niger* in Rigg Bay, south of Garliestown.

The wetness of the season prevented us from properly searching Dowalton Loch, but around its margin we found *Ranunculus sceleratus, Sagina nodosa, Filago germanica, Cryptogramme crispa, Ophioglossum vulgatum,* etc.

I next visited Drummore, a village four miles north of the Mull of Galloway, with the intention of confirming some of the plant-records from that district. Along the Mull Head, and the west coast of Kirkmaiden Parish, I got *Astragalus Hypoglottis, Oxytropis uralensis, Crithmum maritimum, Inula crithmoides, Statice binervosa* vars. *occidentalis* and *intermedia, Mertensia maritima, Euphorbia portlandica,* and *Scirpus Savii.* I failed, however, to find *Brassica monensis, Ononis reclinata, Apium graveolens, Atriplex portulacoides,* and *Malaxis paludosa. Ononis reclinata* is in all likelihood now extinct from this its only British station. It has not been gathered for many years on the farm of Cardrain, where Professor Graham discovered it in 1835.

In continuation of new plant-records for Wigtownshire, I add the following from the neighbourhood of Drummore: **Polygala vulgaris* var. *oxyptera,* on a bank facing the sea at Drummore. This variety has been found in Scotland previously only near Stirling. **Cerastium semidecandrum,* south of Drummore; **Sagina maritima* var. *densa,* West Tarbert; **Spergularia salina* var. *media,* Port Logan Quay; **Geranium pratense,* High Drummore; **Trifolium striatum,* south of Drummore in plenty; **Vicia lathyroides,* in fields south of Drummore; **Bidens tripartita,* Ardwell Mill-dam; **Erythræa Centaurium* var. *pseudo-latifolia* (=*E. capitata,* Koch), on the west coast in plenty; **Mentha aquatica* var. *subglabra,* Ardwell Mill-dam; **Listera cordata,* Inshanks Moor and East Tarbert; **Bromus asper,* Grennan Wood and south of Maryport; **Bromus arvensis,* south of Drummore Quay; and **Chara contraria,* on the west coast.

In addition to the above new records, I may include the following *Rubi* and *Rosæ,* gathered in 1889 by Mr. Charles Bailey, of Manchester: *Rubus rhamnifolius, R. umbrosus, R. Sprengelii* (the last was gathered near Newton-Stewart, and is the first record for this bramble in Scotland), *Rosa subcristata R. mollis,* and *R. subglobosa.*

Some other interesting plants around Drummore may be mentioned. *Vicia lutea* at the north end of New England Bay, and *Orchis pyramidalis* at Killiness Point, still maintain their ground. South of Drummore, along the shore, may be gathered *Glaucium luteum*, *Senebiera Coronopus*, *Raphanus maritimus*, *Cerastium tetrandrum*, *Sagina apetala*, *S. maritima*, *Medicago lupulina*, *Trifolium arvense*, *Vicia hirsuta*, *Potentilla reptans*, *Eryngium maritimum*, *Filago minima*, *F. germanica*, *Lycopsis arvensis*, *Calystegia Soldanella*, *Ammophila arundinacea*, and *Festuca sciuroides*. At Grennan Wood *Vicia sylvatica* grows in abundance. At Port Logan I found *Spergularia rupestris*, and further south *Thymus Chamædrys* and *Empetrum nigrum*. At Clanyard Bay grow *Agrimonia Eupatoria*, *Carlina vulgaris*, and *Juniperus communis*. At Portencorkrie Bay I gathered *Ligusticum scoticum*, *Aster Tripolium*, *Convolvulus arvensis*, *Scirpus maritimus*, *Carex vulpina*, and *C. paludosa*. On the Mull Head grow *Radiola Millegrana*, *Geranium sanguineum*, *Parnassia palustris*, *Œnanthe Lachenalii*, and *Selaginella selaginoides*. Around Drummore are *Hypericum Elodes*, *Lavatera arborea* (but planted), *Malva sylvestris*, *Ornithopus perpusillus*, *Conium maculatum*, *Carduus tenuiflorus*, *Veronica scutellata*, *Lamium intermedium*, *Urtica urens*, *Habenaria viridis*, and *Alisma ranunculoides*. At Ardwell Mill-dam were *Senecio saracenicus*, *Lysimachia Nummularia*, and *Littorella lacustris*; and on the shore about Sandhead, *Cakile maritima* and *Equisetum maximum*.

Doubtful plants have been referred to Mr. Arthur Bennett, F.L.S.

## Kirkcudbrightshire.

This year I have found *Thalictrum flavum* var. *sphærocarpum*, Lej., in Kenmure Holms, New Galloway; *Juncus tenuis* in another station near Shiel; the mosses *Scleropodium cæspitosum* in abundance in Kenmure Holms, and *Didymodon*

*flexifolius* on Kinervie Moor, on which I also found plenty of the lichen *Cladonia leptophylla.* I have also gathered the hepatic *Harpanthus Flotowii* in Glenlee Glen, New Galloway.

In Borgue and near Gatehouse Mr. Charles Bailey in 1889 gathered *Rubus fissus, R. Koehleri, R. hirtus, R. umbrosus*, Bab., *R. affinis*, Bab., and opposite Newton-Stewart *R. Sprengelii.* He also found near Gatehouse *Rosa sphærica, R. tomentosa, R. subcristata, R. Watsoni*, and *R. rubiginosa.*

## Dumfriesshire.

Mr. John T. Johnstone has found *Potentilla alpestris* on Blackhope, near Moffat. This is a very interesting addition to the Flora of Dumfriesshire. He also records *Peucedanum Ostruthium* from Moffat, and *Pyrola secunda* from near Beld Craig. The Rev. E. F. Linton, M.A., records *Rosa hibernica* from the Grey Mare's Tail.

## XXXI.

# *NOTES ON* RHINCALANUS GIGAS, *BRADY, AND* ECTINOSOMA ATLANTICUM, *BRADY AND ROBERTSON.*

BY THOMAS SCOTT, F.L.S., NATURALIST TO THE FISHERY BOARD FOR SCOTLAND.

[Read 25th November, 1890.]

*Rhincalanus gigas* was first observed by my son (Andrew Scott) when looking over some tow-net material collected at Orkney in 1889. He drew my attention to two specimens, but I laid them aside with the intention of examining them at my leisure, and they were forgotten for a considerable time. During the early part of the present year, I was examining some tow-nettings collected about 22 miles south-east of Montrose in the beginning of February, when another example was obtained. I thereafter submitted specimens to Professor G. S. Brady, F.R.S., who identified them as *Rhincalanus gigas,* Brady. He stated at the same time that he had some doubt as to *Rh. gigas* being really distinct from *Rh. cornutus,* Dana. *Rhincalanus* has been recorded from various places, but has not, so far as I know, been previously observed in British waters. It is fully described in the Report on the *Challenger* Copepoda.

*Ectinosoma atlanticum* was first described, under the generic name of *Microstella,* from specimens collected by Mr. E. C. Davidson in the open sea to the West of Ireland (see *Mon. Brit. Copep.*). It is an exceedingly small species. I have not yet had time to measure the dimensions of any of the specimens, but Dr. Brady gives $\frac{1}{60}$ of an inch as

the size of those described by him. It is a well-marked species, and is easily distinguishable from any other British *Ectinosoma* by the comparatively elongated joints of the anterior antennæ and by the long setæ of the fifth feet. It has been obtained at several places in the open sea to the west and south-west of Ireland, and in Kinsale Harbour; while Giesbrecht and Mobius have taken it, and also *Rhincalanus gigas*, in the neighbourhood of Kiel. There is no previous record of its occurrence on the East of Scotland. It was frequent in midwater-net material collected eastward of Inchkeith, Firth of Forth, but less frequent in the surface-net gatherings.

## XXXII.

# *NOTES ON* CECROPS LATREILLII, *LEACH, AND* LÆMARGUS MURICATUS, *KROYER.*

BY ANDREW SCOTT.

[Read 25th November, 1890.]

THE two species of fish-parasites under notice were found on a specimen of the Short Sunfish (*Orthagoriscus molæ*), about 4 feet in length, which was captured near Inchkolm, in the Firth of Forth, on 10th October last.

*Cecrops latreillii*, which was found adhering to the gills of the fish, seems to be of frequent occurrence on *O. molæ*. It is mentioned by Baird, in his *History of the British Entomostraca*, as having been found in a number of localities, and he states that "in all instances they were taken from the Sunfish and adhering to the gills." White, in his *Popular History of British Crustacea*, says that "it is found on the gills of the Sunfish occasionally caught on the coasts of England and Ireland." Edward of Banff also recorded it from the Moray Firth, where it was taken on the gills of the Oblong Sunfish (*Orthagoricus oblongus*) as well as on those of *O. molæ*.

*Læmargus muricatus* was found in two hollows which it had eaten inwards through the skin of the fish. One of the hollows was in front and the other behind the anal fin. The species appears to be gregarious in its habit, as a number of specimens were occupying each hollow. They adhered to the flesh of the fish by means of the strong hooks of the foot-jaws, so that it was somewhat difficult to detach them without injuring them. This species is mentioned by Baird and White. Edward also records it from the Moray Firth, but it does not appear to be so common as *Cecrops latreillii*.

*Læmargus* differs from *Cecrops* in the feet being foliaceous and branchial, and the upper segments of the thorax are also small but distinct.

XXXIII.

## *JOTTINGS FROM MY NOTE-BOOK.*

BY DAVID ROBERTSON, F.L.S., F.G.S.

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### PHYCIS BLENNOIDES (*Brün.*).

[Read 29th April, 1890.]

A SPECIMEN of this fish was recently brought to me by a local fisherman, who stated that he had never before seen one of the same kind. It measured as follows: length, 24 inches; longer forked ventral fin, 6½ inches; shorter fin, 5 inches.

This species seems to have been sparingly taken in Scotland, England, and Ireland. It also occurs along the coasts of Scandinavia, the German Ocean, and the Atlantic coasts of Europe, extending into the Mediterranean where it is common.

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### ZEUGOPTERUS PUNCTATUS, *Bl.* (*Rhombus hirtus*, Yarrell).

[Read 23rd February, 1892.]

THE specimen under notice was taken by the long line on the west side of Cumbrae in 20 fathoms water, bottom hard ground. Although this fish is not considered rare, and appears to be widely distributed all round the British coasts, it does not seem to be anywhere abundant. Day, in his *British Fishes*, states that among other places it occurs in Scotland at the Orkneys, Aberdeen, Firth of Forth, Berwickshire, and Loch Creran, Argyllshire; in England, at Penzance, Bridlington, St. Leonards, Teignmouth, and the British Channel; and at various places round the coast of Ireland.

This species does not appear to acquire any great size, and the same authority states that in British

waters it attains a length of 7 or 8 inches. The chief interest in the specimen under notice is its size. When brought to me in the wet state it was fully 8½ inches in length. As I had not at the time a proper vessel to preserve it in, I dried it, which has caused it to shrink a little. It is still, however, almost 8½ inches in length.

A few years ago I exhibited before this Society a specimen of the same species about 2½ inches long, and I have since seen one or two about the same size. So far as I can learn from the fishermen, this fish does not seem to be often noticed in the Firth of Clyde. The man from whom I had the present specimen did not remember of ever having seen one resembling it. A fish not usually exceeding 7 or 8 inches in length, and seldom attaining that size, can scarcely be considered marketable; and the fishermen do not, as a rule, care to take much notice of captures which do not bring them bread. This may account, in some measure, for such small species not being more frequently brought under notice. The fishermen, in the course of their daily employment, have great opportunities of getting rarities; and it is a pity that these treasures, found and thrown away, cannot be more fully utilised. There is no want of shrewdness among our fishermen; and if there could be any means of enlisting their interest in the subject, there can be no doubt that they would become important auxiliaries in bringing to our knowledge many of the novelties of the deep. Many of our greatest works on marine zoology have been much indebted to the labours of the fishermen.

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### PLEUROBRANCHUS PLUMULA, *Mont.*

[Read 29th September, 1891.]

THE specimen now exhibited to the Society was taken under stones at the Allans, Cumbrae, at low water during spring tides.

At a meeting of this Society about twenty-nine

years ago, before the Society had commenced the regular publication of its *Proceedings*, I exhibited a specimen of *P. plumula*, which had been taken at the same place and under conditions similar to those above referred to. At that time the species was considered rare by us, and so far as it has come under my own notice it may still be considered so. The picking up of animals of that kind, however, only now and again, is no proof that they are rare, for when we have become better acquainted with their habits, and learned where to search for them, we may find that they are not so rare as former experience had led us to believe.

Jeffreys says that the habitat of this species is mostly under stones at low-water, but occasionally in the laminarian and coralline zones.* Forbes and Hanley state that it lives between tide-mark, and that although seldom taken it appears to have a wide range of distribution, *e.g.*, Exmouth, Guernsey, Salcombe Bay, Milford Haven, Isle of Man, Sound of Skye, Scarborough, Coast of Northumberland, and Malbay (West Coast of Ireland).†

I may mention that *Pleurobranchus membranaceus*, Mont., was often taken in the dredgings of the *Medusa* in the Firth of Clyde.

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## URASTER GLACIALIS, *Linn.*

[Read 30th September, 1890.]

So far as I know, it is an unusual or perhaps even an unrecorded occurrence for this species to have more than five rays. The example under notice was taken in about six feet of water off the east side of the Castle, Little Cumbrae. When newly taken, the rays and disk were cream-coloured, with the exception of about an inch of bright reddish purple at the extremity of each ray, the colour increasing in intensity as it reached the end of the

* Jeffreys, *British Conchology*, vol. v., p. 12.

† Forbes and Hanley, *British Mollusca*, vol. iii., p. 561.

ray. Each ray measured six inches long, and the disk about one inch across. The upper two-thirds of the spines on the ridges of the rays are white, and at the base pale blue thickly encircled with rough short papillæform spines. From seeing a specimen in the dried state, one can form no idea of the appearance of *Uraster glacialis* when alive. This is especially the case with the larger sizes. Those in which the rays do not exceed three or four inches in length generally retain their angular form, but the larger specimens seldom do so, the rays becoming flatter and broader. This six-rayed example might have retained more of its life-characters had it been dried under more favourable circumstances. The weather at the time was damp and wet, and the heat of a fire is not very suitable for drying starfishes, as it has a tendency to reduce them to a soft state in which they are ready to part with their rays close by the disk. This is also the case with *Crebella rosea* under similar treatment.

Forbes, in his *History of British Starfishes*, states that the colour of *Uraster glacialis* is reddish or orange, and one which he obtained on the Manx coast was bright red.

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## ASCOPHYLLUM MACKAII (*Turn.*) *Holm. et Batt.*, FORMA ROBERTSONI, *Batt.*

[Read 24th November, 1891.]

IN September last, when at Lochranza, I found this seaweed in so great abundance that it might have been gathered by the cart-load. It grew in semi-globular tufts on the flat shore between high and low water, covering a large extent of the shore, and keeping its position on the soft gravelly mud without root or other attachment. We cannot think that it could live in this unfixed state without good shelter, such as it has in the upper bight of Lochranza, as during every storm it would be liable to be cast on the shore and destroyed.

As I had gathered *Ascophyllum Mackaii* in Birterbuie Bay, Ireland, a few years ago, the Lochranza plant seemed to be the same or closely allied to it. I submitted specimens to Mr. E. A. L. Batters, LL.B., F.L.S., one of our ablest phycologists, who pronounced the plant to be *A. Mackaii*; but as it differs in various particulars from the type, he proposes to give it the above varietal name.*

Harvey figures *Fucus Mackaii* in his *Phycologia Britannica*, vol. i., pl. lii., and states that a doubt rested on the validity of the species, "the resemblance in many respects to a dwarfed variety of *Fucus nodosus* suggesting the probability that it is only a form of that plant." In one particular the suggestion is so far supported by the Lochranza plants as they are greatly infested by *Polysiphonia fastigiata*, a constant parasite of *Ascophyllum nodosum*.

*A. Mackaii* has also been recorded from Loch Seaforth, Arisaig, Loch Coul, Sutherland, East of Skye, and head of Loch Duich.

* See *Grevillea*, vol. xxi. (1892), p. 13.

## XXXIV.

# *NOTES ON THE OCCURRENCE OF* HELOTIUM MARCHANTIÆ, *BERK., IN AYRSHIRE.*

BY D. A. BOYD.

[Read 29th March, 1892.]

In March, 1890, I was so fortunate as to discover several specimens of this Discomycete on a moist bank near the side of the Kilbride Burn, about half a mile above the village of Seamill, where the stream enters the sea. In the beginning of the present month I again obtained a few specimens at the same place, but afterwards found the fungus in much greater abundance under the shade of some trees about 300 yards further down the stream. In both places it grew on the upper surface of faded spots on the thallus of *Conocephalus conicus* (L.), one of the Marchantiaceæ.

This fungus was described by Berkeley,* under the name of *Peziza marchantiæ*, from specimens discovered on *Asterella hemispherica* (*Marchantia hemispherica*, L.) at Whittlesea Mere, but no other English locality appears to have since been recorded for it. In Scotland it has only been recorded for Jedburgh, where it was found on *Conocephalus conicus*, more than thirty years ago, by the late Mr. Archibald Jerdon. Outside of Britain its range of distribution is apparently confined to Scandinavia and Finland.

It is reported to grow on the fading thallus of the liverworts named, but the Ayrshire specimens were mostly confined to rounded or oval spots of a yellowish-white colour. As in many cases the faded spots occurred on an otherwise healthy thallus, they

*Smith's *English Flora*, vol. v. (1837), p. 204.

may have been produced by the mycelium of the fungus rather than by independent decay of the tissue. The fungus was not observed on a totally withered or rotten thallus.

The cups, which are well-described by Mr. Phillips,* vary considerably in size and form, but average from about $\frac{1}{2}$ to $\frac{3}{4}$ of a line in breadth, although shrinking considerably when dry; they are shortly stipitate or sessile; of an obconical shape, through the confluence of the head with the thick stem; of a pale yellowish-brown colour, becoming darker when dry; and are mostly solitary, although sometimes produced in pairs from the same base.

As this fungus is very inconspicuous, and therefore readily overlooked, its apparent rarity may be partly due to a misunderstanding as to the period of its development. It is generally believed to have been found in May by Messrs. Berkeley and Jerdon, but I have not been able to obtain specimens later than the month of March, although I searched carefully for them in April and May, and also throughout the autumn. It is not improbable, therefore, that if a careful search were made for this plant not later than the third week of March, many new British stations might be discovered for it, as the liverwort *Conocephalus conicus*, on which it grows, is common in most districts.

* *Manual of the British Discomycetes* (1887), p. 164.

# PROCEEDINGS

OF THE

# NATURAL HISTORY SOCIETY OF GLASGOW.

## SUMMER SESSION, 1888.

### THE SOCIETY'S ROOMS, 207 BATH STREET.

16th May, 1888.

Dr. James Stirton, F.L.S., in the Chair.

Mr. Richard M'Kay reported on an excursion made to Nitshill on 12th inst.

Mr. D. A. Boyd exhibited specimens of several species of Isopods from West Kilbride, Ayrshire, including *Porcellio armadilloides*, Lereb., *Idotea tricuspidata*, Desm., and *Næsa bidentata*, Adams.

Mr. Thomas King, Vice-President, exhibited a specimen of *Morchella semilibera*, DC., from Darnley Glen, and stated that the species had not been previously recorded for the West of Scotland.

Mr. R. Broom, B.Sc., showed a number of microscopical preparations, illustrating the development of enamel and dentine. He gave an interesting account of the various stages in the development of a tooth, and of the individual dental tissues. Among the preparations submitted were some very fine sections of the lower incisors of a seven-month human fœtus, which showed very distinctly the connection between the enamel-cells and the enamel-prisms, Tome's processes being clearly seen passing into the centre of the prisms. He also exhibited numerous detached enamel-cells showing Tome's processes, and some detached odontoblasts, as well as odontoblasts connected with the dentine.

Mr. Matthew Ballantine exhibited a series of microscopical slides of Diatomaceæ and other objects.

29TH MAY, 1888.

Mr. Thomas King, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an excursion made to Dalry on 26th inst.

The Chairman made some remarks on plants observed by him when visiting Langbank on 26th inst., among which were *Erophila vulgaris*, DC., *Sisymbrium Thaliana*, Hook., *Lepidium Smithii*, Hook., *Stellaria nemorum*, L., *Vicia angustifolia*, Roth, *Chrysosplenium alternifolium*, L., *Valerianella olitoria*, Mœnch, *Taraxacum officinale*, Web., var. *palustre*, DC., *Myosotis versicolor*, Reichb., *Veronica montana*, L., etc.

He also exhibited specimens of *Draba muralis*, L., from Innellan.

Mr. Henry M'Culloch showed a specimen of the Great Spotted Woodpecker, *Picus major*, L., killed at Kildalton in December last, and kindly lent by Mrs. Ramsay, Kildalton, for exhibition to the Society.

Mr. Walter N. Robinson exhibited two living Ringed Snakes, *Tropidonotus natrix*, Ray, both measuring over 30 inches in length. For comparison, specimens of two allied species—*Tropidonotus stolatus*, L., from Ceylon, and *T. subminuatus*, L., from Siam—were shown by Mr. R. Broom, B.Sc.

Mr. Broom also exhibited several Trilobites, and made some remarks on the structure of the eye of these fossil crustacea, as illustrated by one of the specimens, in which the individual lenses forming the eye could be distinctly observed.

Mr. R. Turner read a paper on "Diatoms," in which the structure and modes of reproduction of these plants were described, and an account given of recent researches as to the development of the auxospore. The paper was illustrated with diagrams, and photographs of several species.

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12TH JUNE, 1888.

Mr. Peter Ewing, Vice-President, in the Chair.

The Chairman exhibited growing plants of *Thlaspi alpestre*, L., and *Claytonia perfoliata*, Don, which had for some time been under cultivation by him.

Mr. Johnston Shearer exhibited part of a branch from an unusual variety of Hornbeam *(Carpinus)*, grown on the estate of Rosehall, near Glasgow, and remarkable for its long, thin, drooping branches.

Mr. James J. F. X. King showed some exceptionally small specimens of *Chætopteryx villosa*, F., collected by him at Wanlockhead.

The Secretary (Mr. John Trotter) read a paper by Mr. P. Cameron, F.E.S., Corresponding Member, on "The Natural History of the Oceanic Islands." He described the various agencies by which seeds, spores, etc., could be conveyed to such islands, and stated that plants occur there which have long been extinct in all other parts of the world. It was accordingly of the utmost importance that a thorough investigation of this subject should be made, as much valuable aid would thereby be afforded towards the solution of some of the chief difficulties connected with the theory of evolution.

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## 26TH JUNE, 1888.

Mr. Thomas King, Vice-President, in the Chair.

The Chairman exhibited specimens of several plants from the Campsie district, including *Sedum villosum*, L., *Gymnostomum microstomum*, Hedw., *Barbula subulata*, L., *Mnium rostratum*, Schrad., etc.

Mr. W. N. Robinson exhibited two living specimens of the Salamander, *Salamandra maculosa*, L., a native of Southern Europe.

Mr. R. Broom, B.Sc., showed a series of microscopical preparations illustrating the development and structure of the spines of the common Hedgehog, *Erinaceus europæus*, L. In some of these the structure of the root-sheaths was very clearly exhibited, and in various logwood-stained sections the elongated nuclei in Heule's layer were distinctly defined. Mr. Broom made some interesting remarks on the specimens, and pointed out the distinction between spines and hairs.

He also exhibited a large number of specimens of a small tape-worm which he had recently taken from the intestines of a Hedgehog.

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## 31ST JULY, 1888.

Mr. Thomas King, Vice President, in the Chair.

Mr. D. A. Boyd reported on an excursion made to Barrmill on 23rd June.

The Chairman exhibited specimens of plants recently collected by him on Ben Lawers, including: *Thalictrum alpinum*, L., *Draba rupestris*, R.Br., *Cochlearia officinalis*, L., var. *alpina*, (Wats.) Bab., *Silene acaulis*, L., *Cerastium alpinum*, L., *Sagina saxatilis*, Fr., *S. nivalis*, Fr., *Potentilla maculata*, Pourr., *P. Sibbaldi*, Hall. f., *Saxifraga oppositifolia*, L., *S. stellaris*, L., *S. cernua*, L., *Myosotis alpestris*, Schmidt, *Salix herbacea*, L., *Juncus*

*biglumis*, L., *J. triglumis*, L., etc.; also *Woodsia hyperborea*, R.Br., collected by Mr. P. Ewing on the Breadalbane range.

Mr. Johnston Shearer exhibited a specimen of *Silaus pratensis*, Bess., gathered at Millport.

Mr. D. A. Boyd exhibited a large specimen of *Ranunculus arvensis*, L., found in a garden at Seamill, West Kilbride. This species is remarkable for the structure of its seed-vessels, which are large and covered with prickles. While common in England, it is rare in Scotland, occurring chiefly in the Eastern Counties from Perth southwards; and in the West of Scotland it has no claim to be regarded as native, although specimens introduced with seeds from England occasionally make their appearance in gardens.

Mr. Boyd also showed some branches from a Rose-bush, having the leaves much mutilated by the operations of the leaf-cutting Bee (*Megachile*). He referred to the habits of this insect, which are well-described by Messrs. Kirby and Spence.* The bee excavates a horizontal cylindrical hole, eight or ten inches long, either in the ground or in rotten wood, and fills the cavity with six or seven consecutive cells, each constructed of four or five layers of oval portions cut from the leaves of the rose. At one end of each cell the portions of leaves are bent so as to form a convex termination. The cell is nearly filled with a rose-coloured mixture of honey and pollen gathered from the flowers of the thistle, and an egg is deposited therein. The lid or stopper of each cell is composed of a closely-fitting circular portion of leaf of the most exact dimensions, and is placed a little way inside the mouth so as to leave sufficient space for the insertion of the rounded base of the next cell, which is constructed in a similar manner.

The Chairman (Mr. King) exhibited the following species of Fungi, gathered at Innellan, viz.: *Agaricus* (*Hypholoma*) *appendiculatus*, Bull., *A.* (*Clitocybe*) *infundibuliformis*, Schæff., var. *membranaceus*, Fl. Dan., *Gomphidius glutinosus*, Schæff., *Hygrophorus conicus*, Scop., *Lactarius deliciosus*, L., and *Boletus flavus*, With.

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14TH AUGUST, 1888.

Mr. Peter Ewing, Vice-President, in the Chair.

The Chairman reported on an excursion made to Ben Lawers and other mountains of the Breadalbane range, on 13th-16th July.

Mr. James Steel exhibited some living specimens of the Blind-worm, *Anguis fragilis*, L., from Ailsa Craig, where this reptile

* Kirby and Spence. *An Introduction to Entomology* (7th Edition, 1856), p. 251.

is abundant under stones. He stated that a Blindworm with legs developed externally had recently been captured on the island, showing clearly that in spite of its serpentiform appearance this reptile belongs to the Lacertilia or Lizard order.

Mr. Steel exhibited a living specimen of the Great Water-newt, *Triton cristatus*, Laurent, which he had had in an aquarium for over five years.

He also showed some very large specimens of the common Periwinkle, *Littorina littorea*, L., from Ailsa Craig, including a variety peculiar to the island, and found only at a considerable depth among the boulders. In this form the lip is white, the remainder of the external surface of the shell being of a very dark colour.

Mr. R. Broom, B.Sc., exhibited a specimen of the skull of the Capybara, the largest of living rodents. This species, which is a native of Brazil, is remarkable for the complicated structure of the last upper molar, the enamel being arranged in much the same manner as in the molar of the elephant, a specimen of which tooth, as well as a skull of the Guinea Pig, was also shown for comparison.

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28TH AUGUST, 1888.

Mr. John Renwick in the Chair.

Mr. R. Turner referred to the loss which the Society had sustained in the death of Mr. Robert Robertson, Thornliebank; and it was resolved to place upon record an expression of the regret of the Members at the announcement of Mr. Robertson's decease, and of their sympathy with his family in their bereavement.

Mr. Donald Farquhar reported on an excursion made to Carluke on 25th inst.

Mr. Christopher Sherry exhibited a specimen of *Ancistrocladus* (*Wormia*) *Burbidgei*, one of the Dipteraceæ, a small order consisting of twelve genera, comprising upwards of one hundred species. These consist of large trees, or more rarely climbing shrubs, growing in the forests of tropical Asia. The leaves are alternate and strongly feather-ribbed, with large deciduous stipules; the calyx is five-lobed, persistent, and afterwards so enlarged as to resemble wings; the petals are five; the stamens are hypogynous, indefinite, and irregularly polyadelphous. The large deciduous stipules resemble those of *Magnolia*, but the most characteristic feature of the order is the enlarged persistent calyx, which forms long winged lobes crowning the fruit.

Mr. Sherry also showed a specimen of *Begonia socotrina*, discovered a few years ago by Professor Bayley Balfour in

the Island of Socotra. The genus *Begonia* contains succulent plants with an acid juice, their chief characteristic being the alternate, oblique, or unequal-sided leaves, whence they are usually called "Elephants'-ears." *B. socotrina*, while possessing the monœcious flowers and other essential features of the Begoniaceæ, differs distinctly from most of the other species in having a peltate leaf similar to that of *Tropæolum*.

He also exhibited an abnormally developed pitcher of *Nepenthes intermedia* with the lid absent and the orifice much contracted, forming a marked contrast to the opening in a well-developed or normal pitcher.

Mr. R. Turner exhibited a specimen of *Geranium pyrenaicum*, Brown f., from the neighbourhood of Edinburgh.

Mr. Turner also read a paper on "The Colours of Flowers," in which he gave an interesting account of the causes of floral colours and the purposes which they served.

## WINTER SESSION 1888-89.

25TH SEPTEMBER, 1888.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. D. A. Boyd referred to the loss which the Society had sustained in the death of Mr. James Ramsay, Honorary Member; and it was resolved that a memorial notice of Mr. Ramsay should be recorded in the Minutes, with an expression of the deep regret of the Members of the Society at the announcement of his decease.

### *IN MEMORIAM*—JAMES RAMSAY.

Mr. Ramsay was a native of Ayrshire, having been born in 1812 in the town of Kilwinning, where his father, Mr. James Ramsay, B.A., was for many years parish schoolmaster and session-clerk. After having received a good education, he came to Glasgow, when about twenty-five years of age, to enter upon a mercantile engagement; and in the city he found more favourable opportunities for cultivating those literary and scientific tastes which he had acquired in his country home. His leisure moments were devoted to reading and study, and the foundations were laid of those habits of accurate research by which he was so marked in after-life. He is reported to have at first taken up the study of Entomology; but the sacrifice of life which its pursuit involved proved distasteful to him, and he finally directed his attention to Botany. Here his love of Nature found ample scope. He soon attained considerable eminence as a botanist, and probably no man in the West of Scotland was better acquainted with our native plants. During two years (1867-68) he acted as Lecturer on Botany in the Glasgow Mechanics' Institution, but his retiring nature induced him to shrink from rather than court publicity. For this reason his name was brought much less frequently and less prominently under the public notice than he deserved, still his attainments were recognised and appreciated by not a few eminent scientific men. For twenty years the successive occupants of the Chair of Botany in Glasgow University have availed themselves of his assistance—always cheerfully given—in the field. Here he was quite in his element, and many

who have been out with him at excursions will remember how readily he sought to distribute the wealth of information which his long experience had enabled him to accumulate.

In addition to his botanical studies, however, Mr. Ramsay found time to devote to numerous other pursuits. He was an accomplished mathematician and an ardent musician. At one time he enjoyed the reputation of ranking among the best flutists in Glasgow, and took part as an amateur in more than one concert. He was also one of the editors of the *British Minstrel*, a popular musical miscellany. He was keenly interested in the poetry of Scotland, and was thoroughly acquainted with the works of all the leading writers of Scottish verse. Along with Sir Michael Connal, he was for some years associated with the Spoutmouth Institute, which has been the means of exercising a beneficial influence on many young men who would otherwise have fallen into the lower ranks of society. For the last twenty-six years Mr. Ramsay was connected with the large publishing establishment of Messrs. Blackie & Sons.

In spite of his advancing years, he continued hale and in comparatively vigorous health until within a few weeks of his death. He died on 10th inst., in the seventy-seventh year of his age.

Mr. Ramsay was elected a Member of this Society on 26th February, 1861, and on 24th September of that year he was appointed a Member of Council. On several subsequent occasions he was elected to the office of Vice-President; and he frequently took part in the business of the meetings by exhibiting specimens and reading papers on the Botany of the district. In 1884, on the unanimous recommendation of the Council, he was elected an Honorary Member.

Although probably best-known to the older Members of the Society, who have enjoyed the privilege of his personal acquaintance, yet the results of his careful and accurate botanical work, extending over so many years, and the importance which has attached to his views on questions relating to the Flora of the district, have made his name familiar to most of the younger generation of local botanists. The record of his life is full of encouragement to all who seek, amid the stir of a busy life, to pass their leisure moments in the calm and peaceful pursuits which the contemplation of Nature affords.

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The following were elected Ordinary Members: Mr. G. MacLellan Blair, 2 Lilybank Terrace, Hillhead; Mr. R. Kennedy, B.Sc., 38 Granby Terrace, Hillhead; Mr. John Currie, 69 St.

Vincent Street; Miss C. Forbes, Kelvinside Academy; Miss R. Walker, 4 Ann Street, Hillhead; Mr. T. L. Wilson, 118 Victoria Street, Hillhead; Mr. John R. M'Farlane, 62 Buchanan Street, Mr. James Gold, 128 Hope Street; Mr. James Carlton, 27 High Street, Rothesay.

Mr. David Pearson exhibited a living specimen of the Australian Piping-Crow (*Gymnorhinus tibicen*), lent by Mr. Peter Muir, St. Enoch Square, for exhibition to the Society. The species belongs to an Australasian group of birds, readily distinguished from the true Corvidæ by the peculiar form of the nostrils, which are long, narrow, sunk in the substance of the bill, and usually quite exposed. The black-and-white plumage is rather handsome, and bears some resemblance to that of the Magpie. The piping song of the bird is not unmusical, and compares favourably with the notes of most others of its tribe. In captivity it displays excellent powers of mimicry.

Mr. Henry M'Culloch exhibited a specimen of *Goliathus cacicus*, a large and beautifully-coloured beetle, from Old Calabar, Western Africa.

Mr. James Steel showed a glass jar with sea-water, containing hundreds of the larval form of the common shore-crab, *Carcinus mænas*, L. He remarked that in their early stage of development many of these crustaceans are pelagic rather than littoral as regards their haunts.

Mr. James J. F. X. King exhibited a series of specimens of *Œcetis notata*, Ramb., a neuropteron recently captured by him on the River Liffey, near Dublin. So far as he had been able to learn, the insect had been taken in Britain in the following localities only: two or three specimens at Weybridge, by Mr. M'Lachlan; one at Barnes Common, by Mr. Morton; and a few on the River Wharfe, near Tadcester, by Mr. Binnie. It had not been recorded from Ireland until discovered by Mr. King in the locality mentioned, where it occurred in profusion. It accordingly forms an interesting addition to the Fauna of Ireland, where the Leptoceridæ are already well represented.

Mr. D. A. Boyd exhibited specimens of *Smynthurus fuscus*, L., *S. luteus*, Lubb., *Papirius ornatus*, Nic., and *P. nigromaculatus*, Lubb., all obtained in the neighbourhood of West Kilbride, Ayrshire; and he made some remarks on the group of Collembola to which these insects belong.

Mr Boyd also showed fertile specimens of *Bartramia Halleriana*, Hedw., and *Fontinalis squamosa*, L., from the neighbourhood of Largs.

Mr. Thomas King, Vice-President, exhibited a collection of Fungi from the district around Glasgow, including specimens of the following species:

*Agaricus* (*Amanita*) *rufescens*, Pers.
(*Tricholoma*) *rutilans*, Schæff.
(*Tricholoma*) *terreus*, Schæff.
(*Clitocybe*) *cerussatus*, Fr.
(*Collybia*) *platyphyllus*, Fr.
(*Collybia*) *maculatus*, Alb. & Schw.
(*Pluteus*) *cervinus*, Schæff.
(*Pholiota*) *squarrosus*, Müll.
(*Pholiota*) *spectabilis*, Fr.
(*Pholiota*) *flammans*, Fr.
(*Hebeloma*) *glutinosus*, Lindgr.
*A.* (*Flammula*) *sapineus*, Fr.
(*Stropharia*) *scobinaceus*, Fr.
(*Hypholoma*) *sublateritius*, Schæff.
*Cortinarius* (*Dermocybe*) *cinnamomeus*, Fr
*Paxillus involutus*, Fr.
*Lactarius subdulcis*, Fr.
*camphoratus*, Fr.
*Russula cyanoxantha*, Fr.
*fellea*, Fr.
*emetica*, Fr.
*ochroleuca*, Fr.
*Boletus badius*, Fr.
*luridus*, Schæff.
*Polyporus betulinus*, Fr.
*versicolor*, Fr.
*abietinus*, Fr.
*Stereum hirsutum*, Fr.
*purpureum*, Pers.
*sanguinolentum*, Fr.

Mr. King stated that with the exception of *Agaricus* (*Clitocybe*) *cerussatus*, Fr., which was obtained at Yoker, all the specimens had been gathered in Cadder Wilderness.

Mr. William Stewart exhibited specimens of the following species of *Peziza* gathered by him near Glasgow, viz.:

*P. Adæ*, Sadler.—Whiteinch.
*P. miniata*, Fckl.—Whiteinch.
*P. fimbriata*, Queleti.—Whiteinch
*P. aurantia*, Œd.—Whiteinch.
*P. bufonia*, Pers.—Cadder Wilderness.

Mr. Stewart stated that specimens of *P. Adæ*, Sadler, *P. miniata*, Fckl., and *P. fimbriata*, Queleti, had been submitted to Mr. William Phillips, F.L.S., Shrewsbury, and the two latter species pronounced new to the British Flora.

A paper was communicated by the Rev. A. S. Wilson, M.A., B.Sc., on "The Dispersion of Seeds and Spores"*

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## THE THIRTY-SEVENTH ANNUAL GENERAL MEETING.

30TH OCTOBER, 1888.

Mr. Thomas King, Vice President, in the Chair.

The Secretary (Mr. D. A. Boyd) read the Report of the Council on the business of last Session.

### REPORT OF THE COUNCIL.

The Council beg to report that during the past year there have been added to the Roll of the Society the names of 5

* *Transactions*, vol. iii., p. 50.

Honorary, 10 Corresponding, and 111 Ordinary Members—the present membership being as follows:

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| Honorary, | | 14 |
| Corresponding, | | 41 |
| Ordinary— | | |
| Life Members, | 22 | |
| Annual, | 260 | |
| Suspended, | 5 | 287 |
| Total Membership, | | 342 |

The Obituary Record of the year contains the names of several well-known and much-respected members. Mr. James Ramsay, Honorary Member, was for many years connected with the Society, and was at various times elected an office-bearer. While endowed with other accomplishments in more than ordinary degree, Mr. Ramsay's name will long be associated with the progress of Botany in the West of Scotland. In this department of Science he had attained an eminence which entitled him to be regarded as one of the leading botanists of the district, and his influence was in many ways directed towards the popular diffusion of accurate information regarding our native plants. Probably no one has ever been able to acquire so comprehensive a knowledge of the Flora of Clydesdale and the West of Scotland as he. Professor Alexander Dickson, M.D., LL.D., F.R.S.E., Edinburgh, one of the Ordinary Members, was also connected with the Society for many years; and both as a member and office-bearer he took an active part in promoting its welfare. His contributions to Botanical literature, especially in the department of vegetable morphology, afford evidences of profound scholarship and original research which will secure for them a place amongst the permanent scientific memorials of our country. Mr. Robert Robertson was esteemed by many friends in the Society, alike for his kind and genial disposition and for his enthusiastic attachment to Botanical pursuits.

In reviewing the work of the past winter session, it is gratifying to report that the meetings were marked by an appreciable increase in the importance as well as amount of business brought forward. Although the attendance at the summer meetings and excursions was below the average of past years, yet much useful work has been accomplished, especially in preserving a record of the plants observed at the excursions. Special thanks must be given to those members who have been instrumental in prosecuting this important work; and it is hoped that the range of such observations may in future be so extended as to enable reports on other branches of Natural History to be furnished to the Society. Reports on the business

of the meetings have, as in previous years, been regularly supplied to the local newspapers.

The cordial thanks of the Council and the Society are due to the members for their hearty response to the appeal made last session for placing the affairs of the Society on a more satisfactory basis by the introduction of new members; and it is hoped that the bright prospects of increasing opportunities of work and widening sphere of usefulness, which have opened to the Society, may be realized year by year in its continued prosperity.

To meet the views of Office-Bearers and other Members who had from time to time suggested alterations on the Constitution of the Society, and provide increased facilities for the more successful accomplishment of the work in which the Society is engaged, the Council, at the request of the Society, have bestowed careful consideration on the revision and improvement of the Constitution. In thanking the Society for the unanimity with which their various recommendations were received, the Council beg to express the hope that the efficiency of the new rules will be in all respects fully demonstrated.

Vol. ii., part i., of the Society's *Proceedings and Transactions* has recently been published; and a separate issue of the valuable paper by our President, Mr. David Robertson, F.L.S., F.G.S., on the Amphipoda and Isopoda of the Firth of Clyde, has been prepared in the hope that it may prove of special service to workers in the department of Zoology to which it relates. Part ii., of the *Proceedings and Transactions,* relating to the work of last session, is now in preparation.

The Society continues to be enrolled on the list of correspondents of the British Association. On the occasion of the recent visit of the Association to Bath, Professor F. O. Bower, D.Sc., F.L.S., kindly acted as our representative; and the Society must gratefully acknowledge its indebtedness to him for his services so generously bestowed.

Special thanks are also due to various members and friends, to whom, during the past year, we have been indebted for the addition of books to the library or for donations to the funds of the Society, as well as to all who have in any way endeavoured to assist in the work of the Society or to promote its welfare.

The Treasurer (Mr. John Renwick) submitted his annual Financial Statement, which showed a balance of £122 7s. 10½d. at the credit of the Society.

The Librarian (Mr. James J. F. X. King) reported as follows:

During the year over 450 separate publications have been added to the Library, which now contains over 1000 bound volumes, all in good condition, the large increase being due to part of the special Library-fund having been devoted to the

binding of sets of *Proceedings* of other Societies, and other works which had not previously been placed on the catalogue of bound volumes.

Only 145 volumes (95 during the winter session and 50 during the summer session) were taken out by the Members, as compared with 205 during the previous year.

Vol. ii., part i., of the Society's *Proceedings and Transactions* has been forwarded to about 150 Societies, Magazines, and Institutions.

The reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. A. Somerville, B.Sc., F.L.S., was appointed a Vice-President. Mr. William Stewart, Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., and Messrs. Robert Broom, B.Sc., Thomas F. Gilmour, M.D., L.R.C.P.E., C. Fred. Pollock, M.D., F.R.C.S.E., F.R.S.E., James Colville, M.A., D.Sc., and Christopher Sherry were elected Members of Council—the Council being as follows: President, David Robertson, F.L.S., F.G.S.; Vice-Presidents, Thomas King, Peter Ewing, A. Somerville, B.Sc., F.L.S.; Secretaries, D. A. Boyd and John Trotter; Treasurer, John Renwick; Librarian, James J. F. X. King; Members of Council, James Colville, M.A., D.Sc., John Broom, James Steel, Christopher Sherry, R. Turner, Joseph Sommerville, James Stirton, M.D., F.L.S., C. Fred. Pollock, M.D., F.R.C.S.E., F.R.S.E., William Stewart, Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., Robert Broom, B.Sc., Thomas F. Gilmour, M.D., L.R.C.P.E.

Messrs. David Pearson and Thomas G. Bishop were appointed Auditors for the ensuing year.

Mr. Edward Morell Holmes, F.L.S., Bradbourne Dene, Sevenoaks, Kent, was elected a Corresponding Member.

The following were elected Ordinary Members: Sir William M'Onie, Heathbank, Pollokshields; Sir James D. Marwick, LL.D., F.R.S.E., Killermont House, Maryhill; Mr. John Muir of Deanston, 6 Park Gardens; Dr. Angus MacPhee, 24 Buckingham Terrace, Hillhead; Miss M. R. Simpson, 8 Mansfield Place, Pitt Street; Miss N. P. Simpson, 8 Mansfield Place, Pitt Street; Mr. F. N. Sloane, C.A., 128 Hope Street; Rev. John A. Abernethy, Linwood Manse, by Paisley; Rev. J. Harrison, Newfield Terrace, Johnstone; Miss K. K. MacLellan, 12 Newton Place.

The following were elected Associates: Mr. Andrew Scott, 20 Baker Street, Greenock; Mr. James Forsyth, 21 Castle Street; Mr. John Anderson, 2 Water Street, Argyll Street, Maryhill; Mrs. W. Watson, Newfield House, Johnstone; Miss M. Kerr, 9 Great Stuart Street, Edinburgh; Mrs. A. Dowell, 13 Palmerston Place, Edinburgh.

In reply to Mr. D. Corse Glen, C.E., F.G.S., the Secretary stated that the Council had recently adopted a resolution to

the effect that the subscriptions of Life Members should be set apart to form a fund separate from the ordinary annual income of the Society, and that the capital-sum derived from such separate fund should be invested so as to yield a source of revenue to the Society.

Mr. A. Somerville, B.Sc., F.L.S., stated that a Committee had recently been appointed by the Council to arrange for the delivery of a course of Popular Lectures by distinguished biologists connected with the Society. It was hoped that these Lectures would not only have the effect of keeping the Society, and its objects and work, before the notice of the public, but also be the means of bringing together the members of the various Biological Societies in the city and surrounding district, and promoting among them a spirit of co-operation. He intimated that arrangements had now been completed for a course of five Lectures, the first of which would be delivered on 13th prox. by Professor James Cossar Ewart, M.D., F.R.C.S.E., F.R.S.E., F.L.S., Edinburgh University.

Mr. James J. F. X. King exhibited an albino Blackbird, *Turdus merula*, L., recently shot in the neighbourhood of Johnstone by Mr. George Allison, Jun.

Rev. John Muir exhibited a series of Ophidia and Scorpionidæ from Southern India, and gave an account of the sub-orders which the specimens illustrated. He also showed an example of *Epicrium glutinosum*, a footless amphibian found in India and a few other Asiatic countries.

Mr. R. Broom, B.Sc., made some remarks on the rarer and more interesting species of Ophidia exhibited by Mr. Muir, among which were specimens of *Cynophis malabaricus*, *Trimeresurus anamallensis*, and *Passerita purpurascens;* and he stated that the last-mentioned species, which is remarkable for its greatly-developed rostral appendage, has never before been recorded for Southern India, but has been known to occur only in Ceylon. The type-specimen in the British Museum, from which the species was originally described, differs in some respects from that obtained in Southern India. In the type-specimen there are 194 ventrals and 154 subcaudals, while in the specimen exhibited from Southern India there are 198 ventrals and as many as 200 subcaudals.*

Mr. Joseph Sommerville made some remarks on the interest which the Scorpionidæ possess from the point of view of Palæontology. Fossil species occur in strata as old as the

* Dr. Albert Günther, F.R.S., of the British Museum, informs me that he regards these differences as probably merely sexual rather than of specific import. He states that the British Museum has recently received a specimen from almost the same locality as that where the specimen exhibited before the Society was obtained. The latter would accordingly appear to be only the second obtained from the mainland of India.—*R. B.*

silurian period, and in Scotland examples have occurred in Liddesdale, Dumbartonshire, and the carboniferous system of Lanarkshire, etc.

A very fine series of the shells of *Isocardia cor.*, L., was submitted for exhibition. Among the specimens was an adult dredged in July, 1887, between Lesser Cumbrae and Brodick, and especially interesting as the first living example recorded from the Clyde. This was kindly lent by His Grace, the Duke of Argyll, K.G., K.T., D.C.L., F.R.S., for exhibition to the Society. Numerous other specimens, from various marine areas, were shown by Mr. David Robertson, F.L.S., F.G.S., President; Dr. John Murray, F.R.S.E., F.L.S., Honorary Member; Mr. W. Anderson Smith, Corresponding Member; Mr. James Paton, F.L.S.; Mr. D. Corse Glen, C.E., F.G.S.; and Mr. A. Somerville, B.Sc., F.L.S.

A paper was read by Mr. Somerville, in which a general account was given of the species and its area of distribution, and reference was made to the various specimens obtained in the West of Scotland.†

Mr. John Renwick exhibited fasciated main-stems of *Pinus austriaca*, grown on the estate of Traquair, Peeblesshire.

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27TH NOVEMBER, 1888.

Mr. A. Somerville, B.Sc., F.L.S., in the Chair.

Mr. William Phillips, F.L.S., Canonbury, Kingsland, Shrewsbury, was elected a Corresponding Member.

The following were elected Ordinary Members: Lieutenant J. G. Millais, of the Seaforth Highlanders, Maryhill Barracks; Mr. John Macrae, 7 Kirklee Gardens, Kelvinside; Mr. Iain Clerk, M.D., C.M., Joint Hospital, Knightswood; Mr. John Henderson, Towerville, Helensburgh.

Messrs. Charles Macfie, 12 Wellfield Terrace, Springburn, and Robert C. Smith, 2 Golfhill Terrace, were elected Associates.

The Secretary (Mr. Boyd) read extracts from the report of the Conference of Delegates of Corresponding Societies of the British Association, held at Bath on 11th September last. These included important suggestions by Professors Bayley Balfour and Bower on method in studying the life-histories of plants, and by Professor Hillhouse on the causes of disappearance of certain native plants from their local haunts.

The Chairman, as Convener of the Lectures Committee, reported that the first lecture of the course had been delivered on 13th inst. by Professor J. Cossar Ewart, M.D., F.R.C.S.E., F.R.S.E., F.L.S., Edinburgh University, the subject being "The Electric Organ of the Skate." The lecture was illustrated with

† *Transactions*, vol. iii., p. 42.

diagrams and preparations showing the structure of the electric organ in various fishes, and its development from muscular tissue. The meeting was presided over by Sir Michael Connal, and at the close some interesting remarks were made by Professor John G. M'Kendrick, M.D., LL.D., F.R.S., on the electric organs regarded from a physiological point of view.

Sir George H. Leith-Buchanan, Bart., Corresponding Member, sent for exhibition an immature female specimen of the Long-tailed Duck, *Harelda glacialis*, L., from Loch Lomond. Specimens, lent by Mr. Henry Martin, of the male and female birds in adult plumage, were also exhibited; and remarks on the species and its habits were made by Mr. James Barrie Low, M.A., and others.

The Chairman (Mr. Somerville) made some remarks on the food of *Harelda* and other allied birds. This, he stated, was generally found to consist largely of Mollusca, the three species most frequently found in the stomachs of the birds being *Mytilus edulis*, L., *Helcion pellucidum*, L., and *Lacuna divaricata*, Fabr., although others of much greater rarity have occasionally been met with. Specimens of the three species referred to were submitted by Mr. Somerville for examination.

On behalf of Mr. Henry M'Culloch, Mr. James Steel exhibited an albino example of the Missel Thrush (*Turdus viscivorus*) from Sligo, and stated that although albino Blackbirds are not unfrequently met with, such varieties of the Missel Thrush are of much rarer occurrence.

Mr. Thomas Scott, Corresponding Member, submitted a series of specimens of *Porcellio pictus*, Brandt & Ratzeburg, an isopod crustacean found by him at Seafield, Leith. Mr. James Steel, by whom the specimens were exhibited, stated that Mr. Scott had also obtained this species in Bute and on the shores of the Cromarty Firth, so that its distribution throughout Scotland appeared to be fairly wide, although no previous evidence of its occurrence north of the border had apparently been placed on record.

Mr. D. A. Boyd stated that *Porcellio pictus* is abundant in the neighbourhood of West Kilbride, where it frequents rather dry spots, such as under slates on roofs, etc.

Mr. Steel showed specimens of *Philoscia muscorum*, Scop., an isopod crustacean obtained in Shielhill Glen, near Greenock, by Mr. Andrew Scott.

He also exhibited a specimen of the tail of the Spotted Sting-Ray, *Trygon uarnak*, Forsk., from China. This fish belongs to the sub-order Batoidei, in which, along with the rays and skates, is included the family Trygonidæ, well illustrated by the species under notice. The Sting-Rays are remarkable for the comparative length and great flexibility of

the tail, which is armed with a poisonous tooth. When the fish is attacked, it twists its tail round its assailant so as to inflict with the projecting tooth a lacerated wound, which is said to be very dangerous and difficult to heal. *T. uarnak* appears to be widely distributed throughout Asiatic waters. In full-grown examples the body measures about three feet in length, while the tail extends to about nine feet.

Mr. Thomas King, Vice-President, showed specimens of *Senecio saracenicus*, L., and *Stachys ambigua*, Sm., recently obtained by him at Inveraray.

Mr. R. S. Wishart, M.A., exhibited specimens of *Alyssum calycinum*, L., *Cerastium arvense*, L., *Vaccinium Vitis-Idæa*, L., and *Kœleria cristata*, Pers., all gathered by him at Boat of Garten.

Mr. D. A. Boyd exhibited leaves, flowers, and seed-pods of Senna from the Island of Hayti. He also showed specimens of the following Fungi from the neighbourhood of West Kilbride:

*Agaricus* (*Clitocybe*) *fragrans*, Sow
(*Stropharia*) *æruginosus*, Curt.
*Hygrophorus pratensis*, Fr.
*Panus conchatus*, Fr.
*Boletus piperatus*, Bull.
*Polyporus cæsius*, Schrad.
*lacteus*, Fr.
*annosus*, Fr.
*Grandinia granulosa*, Fr.
*Cyphella muscigena*, Fr.
*Tremella mesenterica*, Retz.
*Hirneola Auricula-Judæ*, Berk.
*Crucibulum vulgare*, Tul.
*Phragmidium subcorticatum*, (Sch.) Schröt. (teleutospores).
*Puccinia primulæ*, (DC.) Winter (teleutospores).
*saniculæ*, Grev. (teleutospores).
*lychnidearum*, Link (teleutospores).
*Coleosporium sonchi*, (Pers.) Schröt.
*Melampsora farinosa*, (Pers.) Schröt.
*Hypoxylon multiforme*, Fr.
*fuscum*, Fr.
*Lachnella sulphurea*, Pers.
*Leptosphæria doliolum*, (Pers.) De Not.

Mr. Robert M'Lellan exhibited a specimen of *Agaricus* (*Pholiota*) *aureus*, Mat., from the Kelvingrove Park, Glasgow.

Mr. David Robertson, F.L.S., F.G.S., President, submitted a paper entitled "Jottings from my Note-Book—Loch Fyne Herring." *

Mr. P. Cameron, F.E.S., Corresponding Member, communicated a paper on the excessive abundance of *Aphis dianthi*, Schr., round Manchester in September last. He stated that in Cheshire these insects had occurred in such numbers as to prove a nuisance by getting into the eyes of travellers. Near Wilmslow a swarm was seen by him which formed a black cloud; and in various places the insects were collected in heaps on plants and walls, so as to blacken the surface on which they rested. In the city, also, great swarms were observed on many occasions, but these may probably have been

* *Transactions*, vol. iii., p. 22.

borne a considerable distance on the wind. Mr. Cameron's own observations led him to infer that the turnip and mangold fields were the chief sources from whence the swarms were derived. He stated that this insect had occurred in prodigious numbers on former occasions in England as recorded by Gilbert White, as well as in Belgium, where it spread in immense swarms in 1884. *A. dianthi* feeds on a large number of plants. About sixty species are known to be subject to its attacks, and even the poisonous *Atropa Belladonna*, L., is not passed over. It is injurious to many field and garden plants and fruit-trees, the damage inflicted being in proportion to the comparative abundance of the insect. Not unfrequently, when aphides are excessively numerous, the Ladybirds (*Coccinella*) which feed on them are also abundant; but no unusual quantity of these useful creatures was noticed last autumn, although a species of *Aphidius*, an ichneumon which destroys aphides, was exceedingly plentiful.

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27TH DECEMBER, 1888.

Mr. Thomas King, Vice-President, in the Chair.

Mr. Thomas D. Gibson-Carmichael, M.A., F.L.S., Chiefswood, Melrose, was elected a Corresponding Member.

The following were elected Ordinary Members: Professor Henry Drummond, F.R.S.E., F.G.S., 3 Park Circus; Dr. J. Yule Mackay, 34 Elmbank Crescent; Dr. J. Cowan Woodburn, 197 Bath Street; Mr. William Finlayson, 4 Bowmont Gardens, Hillhead.

The following were elected Associates: Mr. P. Wilson, Fisheries Office, Girvan; Miss E. Kallenberg, 28 Belhaven Terrace, Kelvinside; Mr. Archibald E. Robertson, 3 Hillhead Gardens; Mr. Alexander Taylor, 26 Granby Terrace, Hillhead.

Mr. A. Somerville, B.Sc., F.L.S., Convener of the Lectures Committee, reported that the second Lecture of the course had been delivered on 11th inst. by Professor Isaac Bayley Balfour, M.A., M.D., D.Sc., F.R.S., Edinburgh University, the subject being "Some Plant Parasites." The Lecture, which was illustrated with models, diagrams, and lime-light views, was presided over by Sir James Bain, F.R.S.E., F.R.G.S.

Mr. Somerville submitted the Report of a Committee appointed at last meeting to look out for a suitable investment for the funds derived from Life-Members' subscriptions, to the effect that after private inquiries independently conducted by Members of Committee, all which afforded the most satisfactory evidence of the stability of the proposed investment, it had been unanimously decided to recommend that £100, or such sum as may at present be available, be invested on

debenture of The Modern Permanent Building and Investment Society of Melbourne, for five years at five per cent. interest. On the motion of Mr. James J. F. X. King, the Report of the Committee was unanimously adopted.

Mr. R. Broom, B.Sc., exhibited a preparation of the windpipe of the Emu illustrating the peculiar tracheal pouch of that bird. Situated about the middle of the lower half of the trachea is an opening formed by a defect in eight or ten of the rings, and leading into a pouch which lies on the front of the windpipe. This remarkable structure is known to exist only in the Emu, and its use does not seem to have as yet been satisfactorily ascertained.

Professor W. C. M'Intosh, M.D., LL.D., F.R.S., F.L.S., Corresponding Member, sent for exhibition a specimen of *Lesueuria vitrea*, M.-Edwards, a ctenophore new to Britain, obtained on 9th May last in St. Andrews Bay, at a depth of three fathoms, in considerable numbers, among hosts of *Pleurobrachiæ* and *Hydromedusæ*. They were recognised by their great translucency, powerful locomotive flappers, and characteristic shape; moreover, on further examination, their extreme delicacy was conspicuous—indeed, they are the most fragile of a fragile group. From that period onward to September they presented themselves almost daily in great abundance in the mid-water net, and throughout the Bay generally, so that it was as common to meet with them as with *Pleurobrachiæ*. When first obtained the specimens were not large—only from ¾ to 1½ in. in long diameter; but they varied in size from that period onwards, both large and small forms being present throughout, and the maximum of 3½ in., or rather more, being reached on 4th August. The reproductive organs appeared to attain maturity towards the end of June and in July. The capsule of the ovum measured ·016 in., and the ovum proper ·0083 in., in a specimen procured in the first week of July. The examples at St. Andrews swam steadily in the water and more actively than *Beroë*, as might be expected from their very powerful locomotive flappers. The mouth was generally uppermost. Nothing of moment was observed in the gastric chamber, and hence they formed a striking contrast with *Pleurobrachia*. Like the American species, that at St. Andrews was beautifully phosphorescent, the light being intense and almost white, with a scarcely distinguishable tinge of greenish or bluish. It was readily emitted when the water was merely blown upon, and glanced brightly along the ctenophores or locomotive flappers.*

Dr. Francis P. Flemyng, F.R.G.S., Pau, France, sent for

*See "Notes from St. Andrews Marine Laboratory.—No. IX.," by Prof. M'Intosh, M.D., LL.D., F.R.S., etc. *Annals and Magazine of Natural History* for Dec., 1888, p. 464.

exhibition a small herbarium of plants illustrating the Flora of the Pyrenees. Mr. R. Turner made some remarks on the more interesting species represented in the herbarium, and stated that Dr. Flemyng had presented it to the Society. On the motion of the Chairman, a cordial vote of thanks was awarded to Dr. Flemyng for his gift.

Mr. William Stewart exhibited specimens of *Peziza* (*Pyronema*) *domestica*, Sow., an addition to the Fungus-flora of Scotland. He stated that the plant, which grows on damp wall-paper in houses, presents the appearance of minute red cups closely aggregated on a whitish mycelium. It has recently occurred in a house at Balmoral Crescent, Crosshill, and seems to have been noticed for several successive seasons in the same district.

Mr. Stewart also showed a specimen of *Cordyceps capitata*, (Holmsk.) Lk., a Fungus parasite on *Elaphomyces granulatus*, Fr., one of the Tuberaceæ. The specimen was obtained at Inveraray by the Rev. John Stevenson, LL.D., Glamis, Honorary Member, at an Excursion in connection with the recent Conference of the Cryptogamic Society of Scotland.

The Chairman (Mr. King) exhibited specimens of a curious formation formerly known as "*Rhizomorpha fragilis*," but now recognised as the myceliar stage of *Agaricus* (*Armillaria*) *melleus*, Fl. Dan. This consists of a black, flattened, root-like growth, of a hard but somewhat brittle texture, often attaining many feet in length and possessing numerous ramifications. It is developed beneath the bark of trees, penetrating the wood and causing the speedy destruction of the timber affected by its ravages.

Mr. King also exhibited a specimen of *Polyporus brumalis*, Fr., from Cadder Wilderness.

Mr. D. A. Boyd showed specimens of the following Fungi from the neighbourhood of West Kilbride:

*Agaricus* (*Hypholoma*) *fascicularis*, Huds.
*Polyporus perennis*, L.
*P. radiatus*, Sow.
*Hydnum repandum*, L.
*Clavaria rugosa*, Bull.
*Lachnella calycina*, Schum., var. *Trevelyani*, Cooke.
*Phacidium ilicis*, Lib.
*Stegia ilicis*, Fr.

Mr. C. Sherry showed specimens of *Alethopteris lonchitica* and *Neuropteris dilatata*, two fossil ferns from the neighbourhood of Dundee.

Mr. James J. F. X. King exhibited a theodolite having two of the quadrants partially covered with a web of extremely delicate texture, apparently spun by a species of *Psocus*, one of the Neuroptera, which had in some way obtained access to the instrument.

The Secretary (Mr. Boyd) read a short paper by Mr. James M'Andrew, Corresponding Member, reporting the occurrence of *Radula voluta*, Tayl., and other cryptogamic plants, in Ness

Glen, near Dalmellington, Ayrshire. Mr. M'Andrew stated that in July last he had spent a few hours in this glen, where he was rewarded by gathering *Radula voluta*, Tayl. So far as he was aware, this hepatic had not previously been recorded for Scotland. Its most northern station hitherto reported is near Keswick, where it was found a few years ago by Messrs. Carrington and Pearson, growing along with *Plagiochila tridenticulata*, Tayl., another rare hepatic. This species was also found in the Ness Glen by Mr. M'Andrew. He observed that the cryptogamic Flora of this glen was very similar to that of the subalpine glens in Kirkcudbrightshire, which might be expected from their proximity and their geological character. The Ness Glen, however, is deeper and narrower, and therefore more shaded, and consequently the cryptogams are more luxuriant, and perhaps more varied. In addition to some of the commoner mosses and hepatics which grow there in great profusion, Mr. M'Andrew gathered *Hypnum stellatum*, Schreb., var. *protensum*, Brid., a rather rare moss; and *Bartramia pomiformis*, L., var. *crispa*, Swartz, was in large patches on the wet rocks. *Ulota calvescens*, Wils., is reported from this glen, but Mr. M'Andrew found the *Orthotricha* to be not at all plentiful. *Saxifraga hypnoides*, L., a rather rare plant on the Lowther range, was observed in abundance. From the results of his hurried visit, Mr. M'Andrew expressed the belief that this glen would amply repay a day's botanising.

Professor James W. H. Trail, M.A., M.D., F.R.S.E., F.L.S., Corresponding Member, submitted a paper entitled "Revision of the Scotch Perisporiaceæ." *

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29TH JANUARY, 1889.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. William Mackinnon of Loup, C.I.E., F.R.G.S., F.Z.S., Balinakill, Clachan, Argyllshire; and Mr. W. Renny Watson, 16 Woodlands Terrace, were elected Life Members.

Mr. John M. Clavering, 14 Woodside Terrace; Colonel R. E. S. Harington-Stuart of Torrance, East Kilbride; and Mr. Adam Ker, 175 Trongate, were elected Ordinary Members.

Mr. L. Watt, 7 Victoria Place, Clydebank, was elected an Associate.

Mr. A. Somerville, B.Sc., F.L.S., Convener of the Lectures Committee, reported that the third Lecture of the course had been delivered on 8th inst. by Professor W. A. Herdman, D.Sc., F.R.S.E., F.L.S., University College, Liverpool, on "The Life-History of an Ascidian." The Lecture, which was illustrated with diagrams and lime-light views, was presided over by Sir John Neilson Cuthbertson.

* *Transactions*, vol. iii., p. 9.

Mr. Johnston Shearer moved: "That the want of Catalogues of the trees and shrubs in the Public Parks of this city has been much felt by the botanical classes and societies that have visited the Parks for educational purposes, and that it is highly desirable, not only in the interests of students of this branch of Natural Science, but of the citizens generally, that such Catalogues should be prepared and exhibited at convenient stations for reference in the Parks, the trees and shrubs having conspicuous numbers attached to them corresponding with the numbers of the Catalogues; and that it be remitted to the Council of this Society to approach the authorities and endeavour to get them to carry out this suggestion." The motion was seconded by Dr. James Colville. After some discussion, in which it was suggested that the value of any such Catalogues would be much increased by the addition of concise information regarding such points as the affinities and economic importance of the various species of trees and shrubs, the motion was unanimously adopted.

Mr. P. Ewing, Vice-President, made some remarks on *Carex flava*, L., and some of its allies, referring especially to the great amount of variation to which such plants are subject, and consequent difficulty in arriving at a perfectly satisfactory method of their natural arrangement. He exhibited specimens of the following species and varieties, viz.: *Carex binervis*, Sm.; *C. distans*, L.; *C. punctata*, Gaud.; *C. fulva*, Good., type and var. *Hornschuchiana*; *C. extensa*, Good., type and var. *pumila*; *C. flava*, L., type and vars. *elatior*, *lepidocarpa*, and *cyperoides*; and other unnamed forms.

Mr. E. M. Holmes, F.L.S., Corresponding Member, sent for exhibition specimens of the following cryptogamic plants from Sevenoaks, Kent, viz.:

*Hymenostomum squarrosum.*
*Leptotrichum gemmascens.*
*Ephemerum serratum.*
*Clavaria fastigiata.*
*Lecidea ostreata* (with apothecia).
*Parmeliopsis ambigua.*
*Parmelia aleurites.*

Mr. Holmes stated that *Leptotrichum gemmascens* had not previously been recorded for Kent. *Lecidea ostreata*, although exceedingly common on damp palings, appears to be very rarely found in fructification. *Parmeliopsis ambigua* is rare in the Southern Counties, but grows on the palings at Knole Park, Sevenoaks, in company with *Parmelia aleurites*. It may readily be distinguished by the colour of the soredia when moistened, those of *P. ambigua* having a yellowish and those of *P. aleurites* a greyish tint.

He also announced the discovery of *Epicladia Flustræ*, Reinhe, a species of Marine Alga new to science. This was found by Mrs. Holmes at Brighton, where it was growing with

*Callithamnion membranaceum*, Magnus, on the zoophyte *Flustra foliacea*.

Mr. D. A. Boyd exhibited specimens of the following species of Fungi from the neighbourhood of West Kilbride, Ayrshire, viz.:

*Agaricus* (*Crepidotus*) *calolepis*, Fr.
*Polyporus betulinus*, Bull.
*Merulius corium*, Fr. (two forms).
*Solenia anomala*, Pers.
*Hydnum ochraceum*, Pers.
*Phlebia vaga*, Fr.
*Odontia fimbriata*, Pers.
*Corticium cœruleum*, Fr.
*Corticium incarnatum*, Fr.
*C. sambuci*, Pers.
*Cyphella muscicola*, Fr., var. B.
*C. capula*, Fr., var. *cernua*, Schum.
*Clathroptychium rugulosum*, Wall.
*Bactridium flavum*, Kze.
*Hypocrea rufa*, Fr.

He also showed a mass of reddish fibres, found covering a moist bank in Towergill Glen, Largs, and stated that this growth was formerly regarded by botanists as a true fungus, and named *Ozonium auricomum*, Link. It was now, however, considered merely a state of mycelium, probably of one of the larger Hymenomycetes, and therefore possessing no claim to specific recognition.

In evidence of the remarkable mildness of the season, Mr. Boyd showed twigs of Hawthorn, *Cratægus oxyacantha*, L., with fully-developed foliage, gathered on 21st inst. in a wood near West Kilbride; and he stated that on the 19th inst. he had observed *Mercurialis perennis*, L., in flower in the same district. Several instances of early nesting were also reported.

A round concretion was exhibited, about the size of a cricket-ball, taken from the stomach of a cow 4½ years old. It was stated that such growths are caused by hairs and other indigestible particles which adhere to the tongue of the animal when licking its body. They pass into the stomach, where they become agglutinated into a hard and horny mass.

Mr. Thomas King, Vice-President, showed a branch of the Strawberry Tree (*Arbutus Unedo*), and remarked that the shrub is found wild in Ireland and on the Mediterranean Coasts, but in Britain only where planted. He also showed branches of *Garrya elliptica*, with catkins, from the Queen's Park, Glasgow, and stated that the tree, which is a native of the Western States of America, grows well in this country, especially when planted in the vicinity of the sea-coast.

Mr. W. Craibe Angus exhibited a Blackbird (*Turdus Merula*) with white plumage on one of its wings; a chaffinch (*Fringilla Cœlebs*) with abnormally pale plumage of a light chocolate hue; and several Scotch examples of Pallas' Sand-Grouse (*Syrrhaptes paradoxus*). He communicated some interesting notes regarding the morphology, habits, and distribution of the last-men-

tioned species, on which some remarks were also made by Mr. A. Somerville, B.Sc., F.L.S., and others.

A paper entitled "Remarks on Temperature, Vegetation, etc., in the Royal Botanic Garden, Glasgow, 1888," by Mr. Robert Bullen, Curator, was read.*

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26TH FEBRUARY, 1889.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

His Grace the Duke of Argyll, K.G., K.T., D.C.L., LL.D., F.R.S., Inveraray Castle, was elected an Honorary Member.

Mr. James Edmund Harting, F.L.S., F.Z.S., Librarian and Assistant-Secretary of the Linnean Society, was elected a Corresponding Member.

The following were elected Life Members: Mr. P. Mackinnon, Rosemount, Campbeltown; Mr. Duncan Macneill, 50 Old Broad Street, London, E.C.; Mr. Edward Tennent, yr. of the Glen, Innerleithen, Peeblesshire; and Mr. H. J. Tennant, 195 West George Street.

The following were elected Ordinary Members: Mr. James Erskine, M.A., M.B., 6 Newton Street, Charing Cross; Mr. James Jack, National Bank House, Queen Street; and Mr. Richard C. Brooman White of Arddarroch, F.R.H.S., Garelochhead.

The Chairman (Mr. Somerville) as Convener of the Lectures Committee, reported that the fourth Lecture of the Course had been delivered on 12th inst. by Professor D'Arcy W. Thompson, B.A., F.R.S.E., University College, Dundee, on "Fresh-Water and other Polypes." The Lecture, which was illustrated with diagrams and lime-light views, was presided over by Mr. Edward Tennant, yr. of The Glen.

Mr. R. Broom, B.Sc., exhibited a skull of *Epicrium glutinosum*, L., an apodous amphibian found in some parts of Asia, and especially interesting as being, in the opinion of Huxley and others, the nearest living ally of the extinct family of labyrinthodonts. His remarks were further illustrated by drawings showing the structure of the skull in various groups of amphibians.

Mr. Broom also showed a twin apple, and suggested that such abnormalities might probably be instances of atavism. The inflorescence of *Pyrus Malus*, L., is almost a complete umbel, and the cleavage of the floral axis seen in the twin apple would seem to indicate a reversion to the cymose type of inflorescence met with in a number of the other species of *Pyrus*. Mr. Broom said he considered the twin apple to be a case of cleavage and not an instance of fasciation. A similar abnormality was exhibited by Mr. F. N. Sloane, C.A.

* *Transactions*, vol. iii., p. 25.

Mr. James J. F. X. King exhibited specimens of *Lype fragilis*, Pict., and *Agapetus delicatulus*, M'Lach., two species of Trichoptera captured by him in Ireland but not yet discovered in Britain.

The Chairman (Mr. Somerville) exhibited specimens of *Argiope capsula*, Jeffreys, a Brachiopod dredged by him off Iona, in December, 1887, but not previously recorded for the Scottish Coasts.

He also showed specimens of *Malaxis paludosa*, Sw., from Ben Laoigh.

Mr. D. A. Boyd exhibited specimens of *Craterium minutum*, Leers, *Cucurbitaria berberidis*, Gray, *C. laburni*, De Not., *Leptosphæria rusci*, (De Not.) Sacc., and other Fungi from West Kilbride.

Dr. John Grieve, F.R.S.E., F.L.S., showed a young specimen of the John Dory (*Zeus faber*), also examples of *Dysidea fragilis*, *Chalina oculata*, *Halichondria panicea*, and *Isodictya simulans*, four species of Sponge from the Sussex Coast.

Mr. George Russell exhibited a specimen of an unusual form of *Cœlogyne cristata*, one of the Orchidaceæ, having variegated leaves. He stated that the normal colour of the leaves is dark-green, and the pseudo-bulbs are of a lighter shade. Although he had grown this species for about twenty years, he had never before seen it show any tendency to diverge from its normal colour. It is therefore very difficult to account for the departure in the instance under notice. The specimen from which it sprang was very vigorous, and this fact may to some extent explain the change of colour. Mr. Russell was inclined to think that the flow of sap in the growing plant had probably been more than the young leaves could assimilate, and some of the channels may have become partly closed, thus leading to a larger amount of chlorophyll being formed in some parts of the leaves than others.

He also showed a specimen of *Stenia pallida*, one of the Orchidaceæ, chiefly interesting on account of the shape of the flowers, which exactly resemble in form the oil-lamps used in Greece during classic times, and in our own country a few generations ago.

Mr. Thomas King, Vice-President, showed some very beautiful specimens of *Lachnea* (*Sarcoscypha*) *coccinea*, Jacq., gathered by him at Finlaystone, near Langbank.

Mr. David Robertson, F.L.S., F.G.S., communicated a paper entitled "Notice of thirteen Cumacea from the Firth of Clyde."* An ample series of specimens of the various species referred to was submitted for exhibition.

* *Transactions*, vol. iii., p. 47.

26TH MARCH, 1889.

Mr. Thomas King, Vice-President, in the Chair.

Mr. Peter Denny, Dumbarton, was elected a Life Member.

The following were elected Ordinary Members: Mr. J. A. S. Little, M.A., 21 Elgin Terrace, Dowanhill; Mr. C. O. Sonntag, 36 Maxwell Road, Pollokshields; and Mr. John Steel, 239 St. Vincent Street.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, Convener of the Lectures Committee, reported that the fifth and concluding Lecture of the Course had been delivered on 12th inst. by Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., Glasgow University, on "Some evidences of the struggle for existence in Plants of the Jungles of Ceylon." The Lecture, which was illustrated with lime-light views and an extensive series of specimens, was very largely attended, and was presided over by Professor Sir William Thomson, LL.D., D.C.L., F.R.S., P.R.S.E.

Mr. Somerville made some remarks on the success which had attended the Course of Lectures, and stated that the entire expenses had been fully met by donations from Members of the Society and other friends. He moved, and it was unanimously agreed, that the Society should place upon record an expression of its thanks to the respective Lecturers, for their kind services so generously bestowed; and to all who have subscribed to the Lectures Fund or otherwise promoted the success of the course; also to Messrs. George Mason & Co., Opticians, Glasgow, for the great care bestowed by them on the successful manipulation of the lime-light apparatus which had proved so valuable an adjunct to the Lectures.

Mr. D. A. Boyd, exhibited specimens of *Isotoma arborea*, De Geer, and *Anurophorus laricis*, Nic. (*Lipura corticina*, Bour.), two species of Collembola, from West Kilbride.

Mr. James Steel exhibited an extensive collection of shells, chiefly of Land and Fresh-water Mollusca, collected by Mr. James J. F. X. King in various parts of Ireland.

On behalf of Mr. Henry M'Culloch, Mr. Steel showed a very large female Badger (*Meles taxus*), recently killed near Oban, and still in the flesh.

Mr A. Somerville, B.Sc., F.L.S., Vice-President, showed seed-vessels of *Colliguaja odorifera*, Molina, a Euphorbiaceous plant from San Francisco, kindly lent by Mrs. W. Renny Watson for exhibition to the Society. These seed-vessels, which are about the size of a small horse-bean, possess a remarkable power of movement by a series of sudden jerks when placed on their convex surface. Although there is usually no external sign of any defect within, their power of motion depends on the presence of the larva of a small moth (*Carpocapsa saltatoria*, Westw.), which ultimately consumes the entire contents of the

seed-vessels and then passes into the pupa state. The perfect moth finally emerges through a circular opening in the wall of the seed-vessel, which presents the appearance of having been formed by punching rather than eaten out. Specimens of the pupa and moth were also shown.

On behalf of Mr. John Kirsop, Mr. R. Turner exhibited fossil leaves from Ardtun, Mull, and made some remarks on the character of the Flora of the leaf-beds found on that island and in Antrim. These consist of the impressions of leaves of *Platanus*, etc., or sometimes of a mass of leaves, which have been deposited on clay or very fine mud, and are found interstratified amongst basaltic beds and baked to a considerable degree of hardness. Such deposits, with similar remains found in Greenland, etc., have been assigned to the miocene epoch, but are apparently much older than was at first supposed. They seem rather to be palæocene, and to belong to the same period as the Laramie and Fort Union group of American deposits. The Flora is of a temperate rather than a tropical type, and would seem to have existed in a climate much resembling that of the warmer parts of the United States at the present time.

Mr. Peter Ewing, Vice-President, exhibited specimens of the following plants:

*Nymphæa alba*, L., var. *minor*, Syme.—Cantire.

*Polygala vulgaris*, L.—Ben Lawers.

*P. serpyllacea*, Weihe.—Cantire; Milngavie.

*Salvia verticillata*, L.—On Railway embankment near Cambuslang.

*Carex filiformis*, L.—Cantire.

*C. hirta*, L., var. *hirtæformis*, Syme.—Loch Leven (Kinross-shire).

*Avena pratensis*, L., var. *longifolia*, Parn.—Lawers Burn.

*Lolium perenne*, L., forma fasciata.

*Lastræa dilatata*, Presl, var. *alpina*, Moore.—Ben Lawers.

Mr. Joseph Sommerville exhibited leaves of Maple, etc., from Canada, showing the beautiful colours which form so attractive a feature of Canadian woodland scenery in the autumnal season.

Mr. Thomas King, Vice-President, showed flowering specimens of the following shrubs grown in the open air at Innellan, viz.:

*Mahonia aquifolia*, Nut.—Native of North-West America.

*Cydonia japonica*, Pers.— ,, Japan.

*Viburnum Tinus*, Pers.— ,, Southern Europe.

*Pernettya mucronata*, Gaud.—Native of South-West America; Straits of Magellan.

*Daphne Mezereum*, L.—Native of England, etc.

*D. Laureola*, L.—Native of England, etc.

The following papers were read:

"Notes on the Flora of Barra and South Uist," by Mr. A. Somerville, B.Sc., F.L.S., Vice-President.*

"Notes on the Flora of the Outer Hebrides," by Mr. Arthur Bennett, F.L.S., Corresponding Member.†

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30TH APRIL, 1889.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

The following were elected Ordinary Members: Mr. John R. Miller, 2 Somerset Place; Mr. Robert M. Morton, 87 Abercromby Street; and Mr. Alexander Whyte, M.A., B.D., B.Sc., F.L.S., Laurel Bank, Busby.

Mr. R. Broom, B.Sc., exhibited a few Mongolian and other Human Skulls from Siam. He also showed the skull of a synotic cyclopian lamb, and read a paper descriptive of this abnormality.‡

Mr. Robert H. Read, C.E., exhibited an extensive collection of abnormal specimens of British Birds' Eggs. Among these were sets of pure white eggs of the Grouse (*Lagopus scoticus*), pale-blue spotless eggs of the Spotted Flycatcher (*Muscicapa grisola*), spotless eggs of the Snipe (*Gallinago cœlestis*), and a pure white egg of the House Sparrow (*Passer domesticus*); sets of Jackdaw (*Corvus monedula*) and Rook (*Corvus frugilegus*) with very faint markings, and of Pied Wagtail (*Motacilla lugubris*) with unusually dark markings; three sets of Lapwing (*Vanellus cristatus*) with very peculiar coloration—the first set having the colouring matter entirely absent from the small ends of the eggs, the second, taken in the same field about three weeks later, having the colouring matter absent from both ends, and the third with the markings almost entirely absent all over; a set of eggs of the Sedge Warbler (*Acrocephalus phragmitis*) of a bright red colour, a variety unique in eggs of this species so far as Mr. Read is aware; a set of small eggs of the Song Thrush (*Turdus musicus*), and very small eggs of the Sedge Warbler, Chaffinch (*Fringilla Cœlebs*), Pheasant (*Phasianus colchicus*), and Partridge (*Perdix cinerea*).

He also exhibited a nest and eggs of the Marsh Warbler (*Acrocephalus palustris*) taken in Somersetshire, and stated that until a few years ago this bird was scarcely regarded as a truly British species. It seems now, however, to have obtained a permanent footing in some parts of England, and is reported to be steadily increasing in numbers.

Mr. Read also showed nests of the Golden Oriole (*Oriolus galbula*), Serin Finch (*Serinus hortulanus*), and Icterine Warbler

* *Transactions*, vol. iii., p. 31. † *Ibid*, p. 37. ‡ *Transactions*, vol. iii., p. 86.

(*Hypolais icterina*) from Germany; a nest of the Solitary Wasp (*Vespa campanaria*) containing about twelve cells, from Bridge of Weir; and a specimen of beetle (*Acanthocinus ædilis*) recently captured in Perthshire, remarkable for the great length of its antennæ.

Mr. George Russell exhibited inflorescence of *Odontoglossum Pescatori*, showing a twin flower and other abnormal features.

Mr. D. A. Boyd exhibited specimens of *Uromyces poæ*, Rabh. (æcidiospores), *Puccinia albescens*, (Grev.), Plow. (æcidiospores), *P. adoxæ*, DC. (teleutospores), *P. bunii*, (DC.) Winter (teleutospores), and *P. ægopodii*, (Schum) Link (teleutospores), all obtained in the neighbourhood of West Kilbride.

Mr. Thomas King, Vice-President, exhibited specimens of the following Algæ, from various districts in the West of Scotland, viz.:

*Himanthalia lorea.*—Portree.
*Chorda filum.*—Innellan.
  *lomentaria.*—Innellan.
*Odonthalia dentata.*—West Kilbride.
*Polysiphonia fastigiata.*—Kildonan (Arran).
*Bonnemaisonia asparagoides.*—Arran.
*Chylocladia kaliformis.*—Arran.
  *articulata.*—Portree.
*Maugeria sanguinea.*—West Kilbride.
*Nitophyllum punctatum.*—Kildonan (Arran).
  *laceratum.* ,,
*Plocamium coccineum.* ,,
*Schizymenia edulis.* ,,
*Batrachospermum vagans.*—Arran.
*Ptilota plumosa.*—Kildonan (Arran).
  *elegans.* ,,
*Dumontia filiformis.*—Innellan.
*Enteromorpha intestinalis.*—Innellan.
*Ulva latissima.* ,,
  *Linza.* ,,
*Porphyra vulgaris.*—Kildonan (Arran).

Mr. P. Cameron, F.E.S., Corresponding Member, communicated a paper on the Scottish species of Torymina, a group of parasitic Hymenoptera, consisting for the most part of insects of small size, but often possessing extremely brilliant colours. Judging from an ample series of specimens submitted for exhibition, these insects are well represented in the Scottish Fauna, although the British species have as yet been only very imperfectly investigated.

NATURAL HISTORY SOCIETY OF GLASGOW.

## *ABSTRACT STATEMENT OF ACCOUNTS FOR SESSION 1887-88.*

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| To Balance in National Security Savings | | | | | | | |
| Bank, | £34 0 0 | | | | | | |
| ,, Do., on hand, | 1 11 8 | | | | | | |
| | | £35 11 8 | | | | | |
| ,, 226 Members' Annual Subscriptions @ 7s. 6d., | | 84 15 0 | | | | | |
| ,, 11 Life Members' ,, @ £5 5s., | | 57 15 0 | | | | | |
| ,, 89 New Members' Entry-money, | | 33 7 6 | | | | | |
| ,, 14 Members' Arrears, | | 7 2 6 | | | | | |
| ,, *Proceedings*, etc., sold, | | 10 5 5 | | | | | |
| ,, Bank Interest, | | 0 14 2 | | | | | |
| ,, Subscriptions for Library, | | 3 2 0 | | | | | |
| | | £232 13 3 | | | | | |

| | | |
|---|---|---|
| By Rent and Attendance, | | £6 6 0 |
| ,, Postage, Stationery, etc., | | 7 6 8 |
| ,, Printing *Proceedings*, Circulars, etc., | | 79 10 0 |
| ,, Library—Additions, | | 5 0 9 |
| ,, ,, Binding, | | 8 2 6 |
| ,, ,, Insurance, | | 0 6 0 |
| ,, ,, Postages, Carriage, etc., | | 3 13 5½ |
| ,, Balance in National Security | | |
| Savings Bank, | £128 0 2 | |
| Due to Treasurer, | 5 12 3½ | |
| | | 122 7 10½ |
| | | £232 13 3 |

GLASGOW, 18*th October*, 1888.—We have examined the Books and compared the Vouchers, and found the same correct. The Balance in the National Security Savings Bank is One Hundred and Twenty-eight Pounds and Twopence, and the Balance due the Treasurer is Five Pounds Twelve Shillings and Threepence halfpenny.

DAVID PEARSON, *Auditor.*
THOS. G. BISHOP, *Auditor.*

## SUMMER SESSION, 1889.

### 4TH JUNE, 1889.

Professor Thomas King, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an Excursion made to Cumbernauld and Castlecary on 1st inst. From Cumbernauld Railway Station the party proceeded through the Vaut Glen, visiting the ruins of a building at Dunswood which is believed to have been erected for a Culdee place of worship. After exploring the Castlecary Glen, the grounds of Castlecary House were visited. Measurements were made of several large trees. Mr. M'Kay submitted a list of 163 plants seen during the excursion, of which 69 were in flower. Among the more interesting species were the following: *Trollius europæus*, L., *Corydalis claviculata*, DC., *Cardamine amara*, L., *Lathyrus macrorrhizus*, Wimm., *Geum intermedium*, Ehrh., *Fragaria elatior*, Ehrh., *Alchemilla vulgaris*, L., var. *montana*, Willd.; *Pyrus Aria*, Sm. (a tree near the ruins at Dunswood measured 6 ft. 10½ in. in girth at about 3 ft. from the ground), *Myrrhis odorata*, Scop., *Viburnum Opulus*, L., *Cnicus heterophyllus*, Willd., *Taraxacum officinale*, Web., var. *palustre*, DC.; *Ligustrum vulgare*, L. (near Dunswood ruins, stem 11 in. in girth), *Symphytum tuberosum*, L., *Quercus Robur*, L. (near Dunswood ruins, trunk 9 ft. 10½ in. in girth), *Taxus baccata*, L. (a tree within the garden of the old Castlecary Castle measured 8 ft. 4½ in. in girth at 3 ft. 9 in. from the ground; the bole extended to 8 ft. 9 in., with 7 ft. below the first branch), *Scilla nutans*, Sm. (with white flowers), *Carex remota*, L., *C. sylvatica*, Huds., *C. pendula*, Huds., *Milium effusum*, L., *Phragmites communis*, Trin., *Phegopteris Dryopteris*, Fée, and *Ophioglossum vulgatum*, L.

Mr. D. A. Boyd reported that *Apthona cœrulea*, Payk., a small beetle, had been observed on the leaves of *Iris Pseudacorus* near Dunswood, and that the most noteworthy mosses seen in the Vaut Glen were *Gymnostomum tenue*, Schrad., and *Tetrodontium Brownianum*, Dicks., both of which were obtained in fruit.

The Chairman (Professor King) exhibited specimens of *Lamium Galeobdolon*, Crantz, from the neighbourhood of Pollokshaws.

Mr. John Renwick showed specimens of *Asarum europæum*, L., from the woods near Eglinton Castle.

Mr. C. O. Sonntag read a paper on Mounting Botanical Specimens for the Microscope. Having explained how specimens too

hard for cutting were softened, and those too soft hardened, he showed how seeds such as those of the date could be fixed securely in the microtome by cutting notches round them before putting them into melted paraffin wax. He also explained a method of fixing small seeds by glueing them to a piece of cork and then pouring in melted paraffin. Mr. Sonntag described the processes of bleaching, staining, and mounting, and illustrated the last by mounting a section in balsam and another in glycerine. These, along with a number of other objects, were afterwards exhibited by means of an oxyhydrogen microscope lent by Messrs. George Mason & Co.

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18TH JUNE, 1889.

Professor Thomas King in the Chair.

Mr. Richard M'Kay reported on an Excursion made to Campsie Glen on 15th inst., and submitted a list of 183 plants seen, of which 100 were in flower. Among the more interesting species were the following: *Barbarea vulgaris*, R.Br., *Viola lutea*, Huds., type, and var. *amœna*, Syme; *Geranium sylvaticum*, L., *Lathyrus macrorrhizus*, Wimm., *Saxifraga hypnoides*, L., *Parnassia palustris*, L., *Sedum Telephium*, L., *S. villosum*, L., *Valeriana pyrenaica*, L., *Crepis paludosa*, Mœnch, *Leontodon officinale*, Web., var. *palustre*, DC.; *Symphytum tuberosum*, L., *Linaria Cymbalaria*, Mill., *Veronica montana*, L., *Rumex sanguineus*, L., var. *viridis*, Sibth.; *Carex remota*, L., *C. curta*, Good., *C. sylvatica*, Huds., *Melica uniflora*, Retz., *Hymenophyllum unilaterale*, Bory, *Asplenium Adiantum-nigrum*, L., *A. Trichomanes*, L., *Cystopteris fragilis*, Bernh., *Polystichum lobatum*, Presl, and *Phegopteris polypodioides*, Fée.

Mr. D. A. Boyd reported that 108 mosses had been seen at the excursion, of which the most interesting were *Rhabdoweissia denticulata*, Brid., *Zieria julacea*, Schpr., *Cinclidotus fontinaloides*, Hedw., *Orthothecium intricatum*, Hartm., and *Amblystegium fluviatile*, Sw. The following species of Uredineæ were also observed: *Uromyces alchemillæ* (Pers.), uredospores (*Uredo intrusa*, Grev.) on *Alchemilla vulgaris*; *Puccinia violæ* (Schum.), æcidiospores (*Æcidium violæ*, Schum.) on *Viola sylvatica*; *Puccinia pimpinellæ* (Strauss), æcidiospores (*Æ. bunii*, DC.) on *Heracleum Sphondylium*; *Puccinia poarum*, Nielsen, æcidiospores (*Æ. compositarum*, Mart., var. *tussilaginis*, Pers.) on *Tussilago Farfara*; and *Puccinia ægopodii* (Schum.), teleutospores on *Ægopodium Podagraria*.

Mr. Henry M'Culloch exhibited an Albino Song Thrush, *Turdus musicus*, L.

Mr. Robert Broom, M.B., C.M., B.Sc., exhibited a number of teeth illustrating the evolution of the molars of the cow.

He explained Cope's views on the subject, and showed the gradual transition from the simple coned teeth of the pig to the complex grinding-teeth of the ruminant. He also made some remarks on the evolution of the molars of the Mammalia and their mode of action. Among the numerous specimens submitted were teeth of the ruminant, from an unground state to a condition in which the enamel had been completely ground away.

Mr. John Renwick exhibited specimens of various plants from Colmonell, Ayrshire, including *Lychnis alba*, Mill., *Vicia sylvatica*, L., *Galium boreale*, L., *Cladium germanicum*, Schrad., *Carex remota*, L., *C. aquatilis*, Wahl., *C. limosa*, L., *C. pallescens*, L., *C. sylvatica*, Huds., and *C. filiformis*, L.

The Chairman showed specimens of *Nasturtium sylvestre*, R. Br., from Whiteinch, and *Plantago media*, L., from Kilmalcolm; also *Grevillea robusta*, Cun., a native of Australia, sent by Mr. David Gregorson, California, for exhibition to the Society.

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### 30th July, 1889.

Professor Thomas King, Vice-President, in the Chair.

On the motion of Mr. D. A. Boyd, it was unanimously agreed to place upon record an expression of the Society's regret at the loss it had sustained in the death of Mr. James A. Mahony, Ramelton, County Donegal, one of the Corresponding Members.

Mr. Boyd reported on an Excursion made to Barrmill and Blae Loch on 29th June. Among the plants obtained were *Trollius europæus*, L., *Nuphar luteum*, Sm., *Nymphæa alba*, L., and *Antennaria dioica*, R. Br.

Mr. William Stewart and Professor King reported on an Excursion made to Mountstuart, Bute, on 27th inst., and the latter exhibited specimens of some of the plants then obtained, including *Glaucium flavum*, Crantz, *Raphanus maritimus*, Sm., *Eryngium maritimum*, L., and *Listera cordata*, R. Br.

Mr. James Steel exhibited some Lemon-seeds which had germinated while within the fruit.*

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### 13th August, 1889.

Mr. Peter Ewing, Vice-President, in the Chair.

Professor Thomas King reported on an Excursion made to Brother Loch, near Mearns, and showed specimens of some of the plants then obtained, including *Ranunculus hederaceus*,

* See *Proceedings*, vol. ii. (N.S.), p. xxxix.

L., *Sagina nodosa*, E. Mey., *Peplis Portula*, L., *Apium inundatum*, Reichb., *Meum Athamanticum*, Jacq., *Vaccinium Oxycoccos*, L., *Veronica scutellata*, L., *Scutellaria galericulata*, L., *Littorella lacustris*, L., *Polygonum minus*, Huds., *Habenaria viridis*, R. Br., *Sparganium simplex*, Huds., *Scirpus lacustris*, L., and the moss *Climacium dendroides*, L., with remains of fruiting setæ attached to its stems. Specimens of *Eleocharis acicularis*, Sm., from Black Loch, were also submitted.

Mr. Henry M'Culloch exhibited a Pheasant with four legs. In the course of some remarks on this specimen, Mr. Robert Broom, M.B., C.M., B.Sc., stated that the abnormality had been produced by a fission of the vertebral axis in the lumbar region, giving rise to two caudal extremities, each bearing two legs; that the legs which the bird had used for walking were the right leg of the right division, and left of the left division; and that the legs projecting from the sacral region were the internal ones of the two halves. He also remarked that in monstrosities of a similar character the two internal legs are occasionally found united into one.

Mr. Andrew Scobie, Hurlford, exhibited five young Kingfishers (*Alcedo ispida*, L.), and made some remarks on the habits of this species during the period of nidification and incubation.*

Mr. James Steel exhibited specimens of Mollusca, including *Isocardia cor* (L.), taken alive on the East Coast, and *Zonites cellarius* (Müll.), found alive in Buchanan Street, Glasgow.

The Chairman (Mr. Ewing) showed specimens of *Drosera anglica*, Huds., *D. intermedia*, Hayne, and *Utricularia minor*, L., from the Island of Jura.

Mr. D. A. Boyd exhibited specimens of the following Fungi from Ayrshire and Perthshire:

*Paxillus involutus*, Fr.—West Kilbride.

*Cantharellus aurantiacus*, Fr.—Biglees, West Kilbride.

*Panus stypticus*, Fr.—Crosbie, West Kilbride.

*Uromyces trifolii* (Alb. and Schw.).—Teleutospores on *Trifolium repens*; Killin.

*Puccinia violæ* (Schum.).—Uredospores (*Trichobasis violarum*, Berk.) on *Viola sylvatica*; Finlarig, Killin.

*P. oblongata* (Link.).—Uredospores (*Trichobasis oblongata*, Berk.) on *Luzula maxima*; Killin.

*P. bistortæ*, DC.—Teleutospores on *Polygonum viviparum*; Killin.

*P. epilobii*, DC. — Teleutospores on *Epilobium palustre*; Killin.

*P. Fergussoni*, B. and Br.—Teleutospores on *Viola palustris*; Killin.

*Phragmidium violaceum* (Schultz).—Teleutospores on *Rubus fruticosus*; Glenside, West Kilbride.

* *Transactions*, vol. iii., p. 255.

*Melampsora farinosa* (Pers.).—Uredospores (*Lecythea caprearum*, Berk.) on *Salix reticulata*; Craig Chailliach, Killin.

*M. circææ* (Schum.).—Uredospores (*Uredo circææ*, Schum.) on *Circæa Lutetiana*; Finlarig, Killin.

*Coleosporium sonchi* (Pers.).—Uredospores on *Tussilago Farfara*; West Kilbride.

*C. campanulæ* (Pers.).—Uredospores on *Campanula rotundifolia*; Killin.

*Sphærotheca pannosa* (Wallr.) Lev.– On Roses; Killin.

*Podosphæra oxyacanthæ* (DC.).—On *Cratægus Oxyacantha*; West Kilbride.

*Erysiphe Linkii*, Lev.—On *Artemisia vulgaris*; Seamill.

*E. Martii*, Lev.– On *Hypericum hirsutum*; Finlarig, Killin.

*Microsphæria berberidis* (DC.) Lev.—On *Berberis vulgaris*; Glen Lochay, Killin.

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27TH AUGUST, 1889.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. D. A. Boyd reported on an Excursion made to Dundonald on the afternoon of 24th inst. The party from Glasgow walked from Crosshouse Station to Auchans, where they were met by some of the members of the Kilmarnock Philosophical Society. The Auchans Woods, and Merkland Loch and Quarries, were afterwards visited. Among the plants seen were *Lepidium Smithii*, Hook., *Asplenium Ruta-muraria*, L., *Agaricus* (*Amanita*) *rubescens*, Pers., *A.* (*Amanita*) *vaginatus*, Bull., *A.* (*Armillaria*) *melleus*, Fl. Dan., *A.* (*Clitocybe*) *laccatus*, Scop., *A.* (*Hypholoma*) *fascicularis*, Huds., *A.* (*Crepidotus*) *mollis*, Schæff., *Lactarius deliciosus*, Fr., *Cantharellus cibarius*, Fr., *C. aurantiacus*, Fr., *Polyporus abietinus*, Fr., *Stereum rugosum*, Fr., *Puccinia poarum*, Nielsen (as *Æcidium compositarum*, Mart., var. *tussilaginis*, Pers.), and *Coleosporium sonchi* (Pers.).

Mr. William Stewart exhibited specimens of *Lepidium Draba*, L., *Malva rotundifolia*, L., *Erodium cicutarium*, L'Hérit., *Silybum Marianum*, Gærtn., and *Polygonum Roberti*, Loisel., all gathered on the sea-shore and ballast-heaps at Troon.

Professor Thomas King showed specimens of *Chenopodium Bonus-Henricus*, L., and *Cantharellus aurantiacus*, Fr., from Dollar, also *Diphyscium foliosum*, L., from the Ochil Hills, near Castle Campbell.

Mr. D. A. Boyd exhibited specimens of various Fungi from the West Kilbride district, including *Peronospora lactucæ*, Regel, on *Senecio vulgaris*; *Uromyces polygoni* (Pers.) on *Polygonum aviculare*; *Ephelis rhinanthi*, Phil., on *Rhinanthus Crista-galli*; and *Septoria hydrocotyles*, Desm., on *Hydrocotyle vulgaris*.

Professor King exhibited some Microscopic Slides illustrating various easy methods of mounting seeds for examination.

## WINTER SESSION, 1889-90.

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24TH SEPTEMBER, 1889.

Professor Thomas King, Vice-President, in the Chair.

Mr. W. A. Dobie, 11 Bothwell Street, was elected an Ordinary Member.

Mr. Henry M'Culloch exhibited a Scotch specimen of the Spotted Crake, *Porzana maruetta*, Leach ; also an albino example of the Common Gull, *Larus canus*, L., from the neighbourhood of Oban.

Mr. James J. F. X. King exhibited specimens of *Æschna borealis*, Zett., and stated that since 1865, when three specimens had been taken at Rannoch, the species did not appear to have been noticed in this country. When recently visiting the Rannoch district, however, Messrs. King and Morton were successful in obtaining five specimens, and several others were seen by them. He also showed specimens of *Stenophylax infumatus*, M'L., from the Rannoch district, and drew attention to the dark colour of these insects as compared with other examples obtained at Lanark and elsewhere.

Mr. King also exhibited specimens of *Mesophylax impunctatus*, M'L., var. *zetlandicus*, M'L., from Unst, Shetland, and remarked that while only two examples had previously occurred in this country, he had been successful in obtaining over a dozen this season when in Shetland.

Mr. R. S. Wishart, M.A., showed specimens of the following plants from the localities indicated, viz. :

*Astragalus Hypoglottis*, L.—Dunnottar Bay.
*A. glycyphyllos*, L.—Dunnottar Bay.
*Agrimonia Eupatoria*, L.—Stonehaven.
*Ligusticum scoticum*, L.—Garron Point, Stonehaven.
*Eupatorium cannabinum*, L.—Dunnottar Castle.
*Senecio sylvaticus*, L.—Stonehaven.
*Carlina vulgaris*, L.—Muchalls.
*C. acaulis*, DC.—Grindelwald, Switzerland.
*Campanula glomerata*, L.—Stonehaven.
*C. rapunculoides*, L.—Stonehaven.
*Lycium barbatum*, L.—Elliot Water, Forfarshire.
*Kœleria cristata*, Pers.—Stonehaven Moors.

The Chairman (Professor King) made some remarks on the Conference of the Cryptogamic Society of Scotland recently

held at Crieff, and exhibited specimens of the following Fungi collected in that district, viz.:

*Cortinarius* (*Telamonia*) *armillatus*, Fr.—Crieff.

*Lentinus cochleatus*, Fr.—Crieff.

*Strobilomyces strobilaceus*, Berk.—Drummond Castle woods; new to Scotland.

*Dædalia quercina*, Pers.—Drummond Castle woods.

*Craterellus cornucopioides*, Fr.—Drummond Castle woods.

*Helvella crispa*, Fr.—Crieff.

*Geoglossum glabrum*, Pers.—Abercairney.

*Peziza* (*Otidea*) *onotica*, Pers.—Crieff.

Rev. Alexander S. Wilson, M.A., B.Sc., read a paper on the Dispersion of Seeds and Spores.*

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## THE THIRTY-EIGHTH ANNUAL GENERAL MEETING.

29TH OCTOBER, 1889.

Mr. Peter Ewing, Vice-President, in the Chair.

The Secretary (Mr. D. A. Boyd) read the

### REPORT OF THE COUNCIL.

*Membership.*—During the past year there have been added to the Roll of the Society the names of 1 Honorary, 4 Corresponding, and 38 Ordinary Members—the present membership being as follows:

| | | |
|---|---|---|
| Honorary, | | 15 |
| Corresponding, | | 43 |
| Ordinary— | | |
| Life Members, | 28 | |
| Annual, | 271 | |
| Suspended, | 9 | |
| | | 308 |
| Total Membership, | | 366 |

*Obituary.*—The Obituary Record for the year contains the names of Dr. T. B. Grierson, Thornhill, Corresponding Member; Mr. James A. Mahony, Ramelton, County Donegal, Corresponding Member; and Sir James Watson, Life Member. Dr. Grierson, who was elected a Corresponding Member on 2nd March, 1852, was well known for his scientific attainments. Mr. Mahony was formerly a Member and Office-Bearer of the Glasgow Naturalists' Society, and became connected with the Natural History Society of Glasgow in April, 1866, when the former Society was amalgamated with the latter.

* *Transactions*, vol. iii., p. 101.

During the period of his membership he took an active interest in the affairs of this Society, and frequently contributed specimens and papers at the meetings. He also held the office of Librarian for some time, and afterwards acted as a Member of Council. On his removal to Ireland some years ago, his name was transferred to the Roll of Corresponding Members; but he continued occasionally to send specimens for exhibition at the meetings, as well as communications on the natural history and archæology of the district in which he resided. Sir James Watson, elected a Life Member on 29th November, 1887, was a former Lord-Provost of the city. He took a warm interest in social and philanthropic movements, and was a liberal supporter of every scheme designed for the welfare of the community.

*Meetings and Excursions.*—Eight Meetings were held during the Winter Session, at which many interesting zoological and botanical specimens were exhibited and various important communications read. Reports of the meetings were regularly supplied to the local newspapers.

Six Meetings were held during the Summer Session, and an Exhibition of Microscopic Objects took place at the meetings on 4th June and 27th August.

Eight Excursions were made as follows: 1st June, Cumbernauld; 15th June, Campsie Glen; 29th June, Barrmill and Blae Loch; 27th July, Rothesay and Mount Stuart, Bute; 10th August, Brother Loch, Mearns; 24th August, Dundonald; 7th September, Torrance, East Kilbride; 21st September, Milngavie.

*Lectures.*—With the view of keeping the aims and work of the Society before the notice of the public, and promoting friendly relations between the various biological and other kindred Societies in the city and neighbourhood, a special course of five Lectures by distinguished biologists connected with the Society was arranged during last Session, and an invitation issued to the members of the various local Societies to attend. The Lectures were delivered as follows:

13th November.—"The Electric Organ of the Skate," by Professor J. Cossar Ewart, M.D., F.R.C.S.E., F.R.S.E., F.L.S.; Sir Michael Connal in the chair.

11th December.—"Some Plant Parasites," by Professor Isaac Bayley Balfour, M.A., M.D., D.Sc., F.R.S.; Sir James Bain, F.R.S.E., F.R.G.S., in the chair.

8th January.—"The Life-History of an Ascidian," by Professor W. A. Herdman, D.Sc., F.R.S.E., F.L.S.; Sir John Neilson Cuthbertson in the chair.

12th February.—"Fresh-Water and other Polypes," by Professor D'Arcy W. Thompson, B.A., F.R.S.E.; Mr. Edward Tennant, yr. of the Glen in the chair.

12th March.—"Some evidences of the struggle for existence in Plants of the Jungles of Ceylon," by Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S.; Professor Sir William Thomson, LL.D., D.C.L., F.R.S., P.R.S.E., in the chair.

The warmest thanks of the Society are due to the Lecturers, for their kind and generous services; to the members of the Lectures Committee, and especially to the Convener, Mr. A. Somerville, B.Sc., F.L.S., for their laborious care in making and carrying out the necessary arrangements; and to the numerous donors to the Lectures Fund, by whose subscriptions the entire expenses have been defrayed.

*British Association.*—The Society continues to be enrolled on the corresponding list of the British Association. On the occasion of the recent visit of the Association to Newcastle, Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., kindly acted as our delegate, and the grateful thanks of the Society are due to him for these services.

*Donations, etc.*—Special thanks are also due to members and friends who have presented books to the library, subscribed to the funds of the Society, or in any way aided its work or promoted its welfare.

The Treasurer (Mr. John Renwick) submitted an audited Statement of Accounts, showing a balance of £67 12s. 3d. at the credit of the Society, exclusive of £100 invested on debenture, and the value of books and other property insured for £300.

The Librarian (Mr. James J. F. X. King) reported as follows:

About 400 separate publications have been added during the year; these have been obtained by exchange, donation, and purchase. The number of bound volumes in the Library now reaches 1,040. The number of volumes borrowed during the past year was only 139, 29 of which were taken out during the Summer Session; this shows a great falling off from the previous session. With a view to reducing our stock of publications, it is proposed that members should have a copy of Parts II. and V. of the *Transactions of the Glasgow Society of Field Naturalists* free on application to the Librarian. The price of bound copies of the *Fauna and Flora of the West of Scotland* (1876) is now reduced to 1s. 6d.; and members can have unbound copies (in the form of loose sheets) at 6d. each.

The Reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. Robert Turner was elected a Vice-President; Mr. James Steel, a Secretary; and Messrs. Thomas King, R. S. Wishart, M.A., James Barrie Low, M.A., David Pearson, and Johnston Shearer, Members of Council—the Council being as follows: President, David Robertson, F.L.S., F.G.S.; Vice-Presidents, Peter Ewing, A. Somerville, B.Sc., F.L.S., and Robert Turner; Secretaries, D. A. Boyd and James Steel; Treasurer, John Renwick; Librarian, James J. F. X. King; Members of Council, Joseph Sommerville, Johnston Shearer, James Stirton, M.D., F.L.S., C. Fred. Pollock, M.D., F.R.C.S.E.,

F.R.S.E., William Stewart, Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., Robert Broom, M.B., C.M., B.Sc., Thomas F. Gilmour, M.D., L.R.C.P.E., Professor Thomas King, R. S. Wishart, M.A., James Barrie Low, M.A., and David Pearson.

Messrs. Thomas G. Bishop and Duncan Mackenzie were appointed Auditors for the ensuing year.

Mr. Robert Grierson, 186 West George Street; Mr. Francis Gibb M'Intyre, 249 Saracen Street, Possilpark; and Mr. William Marshall, 33 West Cumberland Street, were elected Ordinary Members.

The following were elected Associates: Mr. J. H. Aitken, 257 Saracen Street, Possilpark; Mr. William Campbell, 5 Seafield Cottages, Claythorne, Partick; Mr. George Jack, 7 Eastfield Terrace, Springburn; Mr. G. A. Frank Knight, Rosenlaui, Bearsden; Mr. Henry R. Mathews, jun., 10 Annfield Terrace, West, Partick; and Mr. John Wood, Levern Schoolhouse, Hurlet.

Mr. David Robertson, F.L.S., F.G.S., exhibited specimens of *Tubularia humilis*, Allman, from Cumbrae, and communicated some notes on the species.*

Mr. Malcolm M'Murrich, M.A., M.B., C.M., exhibited specimens of *Calystegia Soldanella*, L., *Euphorbia Paralias*, L., and other plants from the neighbourhood of Dublin.

Professor Thomas King showed specimens of *Galium Mollugo*, L., from Strathblane, and *Juncus tenuis*, Willd., from the neighbourhood of Kilmalcolm.

Professor King reported that when visiting Thornliebank last week he had found a specimen of *Helvella infula*, Schrad., growing on a sloping bank at the railway station. He stated that this fungus is very rare in Scotland, having hitherto been found only at Rothiemurchus and in a shipbuilding yard on the Clyde at Yoker. Mr. William Phillips, F.L.S., Corresponding Member, to whom the specimen had been submitted for verification, remarked that this species differs considerably from the typical form of *Helvella*, and bears a striking resemblance to *Gyromitra*, an allied genus of Discomycetes.

Mr. George Russell showed living specimens of *Acrostichum (Rhipidopteris) peltatum*, Sw., bearing several fertile fronds.

Mr. D. A. Boyd exhibited specimens of *Clavaria fastigiata*, L., and *Geoglossum difforme*, Fr., found among grass on the sea-shore at Chapelton, West Kilbride.

The following papers were read:

"On the Structure of the Root-Sheath in Hedgehog-Spines," by Mr. Robert Broom, M.B., C.M., B.Sc.†

"Notes on some Fresh-water, Brackish-water, and Marine

* *Transactions*, vol. iii., p. 190. † *Ibid.*, p. 127.

Ostracoda new to the Fauna of Orkney," with illustrative specimens, by Mr. Thomas Scott, F.L.S.*

"On *Juncus tenuis*, Willdenow, as a Scottish Plant," by Mr. Peter Ewing, Vice-President.†

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26TH NOVEMBER, 1889.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Henry R. Mathews, jun., 10 Annfield Terrace, West, Partick, was elected an Ordinary Member.

Mr. Robert H. Read, C.E., M.B.O.U., exhibited an extensive series of Nests and Eggs of the Tufted Duck, Teal, Crossbill, Ptarmigan, Greenshank, Great Crested Crebe, Tawny Owl, Buzzard, and other British Birds.

Mr. D. A. Boyd exhibited specimens of various species of Collembola and Thysanura from West Kilbride, including *Papirius ornatus*, Nic., *Templetonia crystallina*, Müll., *Macrotoma plumbea*, L., *M. tridentifera*, Tullb., *Lepidocyrtus cyaneus*, Tullb., *L. lignorum*, Fabr., *Lipura ambulans*, L., and *Machilis maritima*, Leach. Some of the scales with which the body of the last-named insect is covered were shown under the microscope.

Professor Thomas King showed specimens of various Fungi from Craigton Woods, Milngavie, including *Agaricus* (*Pleurotus*) *serotinus*, Schrad., *Polyporus adustus*, Willd., *P. abietinus*, Dicks., and *Tremella foliacea*, Pers.

The following papers were read:

"List of Foraminifera from Portree Bay, Skye," by Mr. David Robertson, F.L.S., F.G.S.‡ The paper was illustrated by means of an ample series of specimens mounted for microscopical examination.

"Additional Notes on the Flora of Wigtonshire, with Notes on Moffat and Kirkcudbrightshire Plants," by Mr. James M'Andrew, Corresponding Member.||

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24TH DECEMBER, 1889.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. James Mitchell, 6 Ure Place, was elected an Ordinary Member.

Mr. Henry M'Culloch exhibited a Blackcock (*Tetrao tetrix*, L.) having the plumage of the back and wings abnormally mottled with white.

Mr. James Steel showed specimens of *Limnæa glabra*, Müll., a fresh-water Mollusk, from the neighbourhood of Airdrie. In

* *Transactions*, vol. iii., p. 91. † *Ibid.*, p. 166. ‡ *Ibid.*, p. 239. || *Ibid.*, p. 131.

Britain the species is found chiefly in the northern counties of England, where it appears to be rather locally distributed. Although formerly introduced into Frankfield Loch, near Glasgow, specimens are now very rarely obtained there, and it has not hitherto been recognised as having a claim to be considered a native of Scotland. Recently, however, it has been discovered in several places near Airdrie, in situations where it could scarcely have been introduced.

Mr. D. A. Boyd exhibited specimens of *Graphiola phœnicis* (Moug.), a fungus parasitic on the leaves of the Date-Palm (*Phœnix dactylifera*), and abundant on almost every plant of *P. dactylifera* in the Palm-house at the Glasgow Botanic Gardens. Mr. Boyd stated that specimens had been submitted to Dr. M. C. Cooke, A.L.S., and Professor J. W. H. Trail, M.D., F.L.S., and reported by the latter to be new to Scotland.

Mr. David Robertson, F.L.S., F.G.S., exhibited specimens of the arenaceous tubes of *Lagis Koreni*, Malagren, and communicated some notes on the habits of the species.*

The Chairman (Mr. Ewing) submitted a paper entitled "Second Contribution to the Topographical Botany of the West of Scotland."†

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## 28th January, 1890.

Mr. R. Turner, Vice-President, in the Chair.

Mr. C. R. B. Ritchie, 9 Park Road, was elected an Associate.

Mr. Henry M'Culloch exhibited a Reeve (*Machetes pugnax*, L.), and a Sparrow (*Passer domesticus*, L.) with partial albino plumage.

On behalf of Mr. Henry Boswell, Corresponding Member, the Secretary (Mr. D. A. Boyd) exhibited specimens of the following exotic Mosses and Hepatics which Mr. Boswell had kindly presented to the Society, viz.: *Dicranum Braunii*, from Samoa; *Leucobryum longifolium*, from Jamaica; *Racomitrium pruinosum*, from Tasmania; *Fissidens circinans*, from Jamaica; *Phyllogonium aureum*, from Jamaica; *Macromitrium cirrhosum*, from Jamaica; *M. mauritianum*, from Mauritius; *Homalia targioniana*, from Nilghiris; *Hookeria aurea*, from Guadaloupe; *H. acicularis*, from Guadaloupe; *Neckera æqualifolia*, from Nilghiris; *Thuidium antillarum*, from Guadaloupe; *T. acuminatum*, from Jamaica; *Lepyrodon mauritianus*, from Mauritius; *Meteorium flexile*, from Jamaica; *M. illecebrum*, from Mexico; *M. patulum*, from South America; *M. squarrosum*, from India; *M. nigricans*, from Guadaloupe; *Cœlidium clandestinum*, from Tasmania; *Ectropothecium globitheca*, from Jamaica; *E. nano-crista-castrensis*, from

* *Transactions*, vol. iii., p. 190. † *Ibid.*, p. 159.

Mauritius; *Microthamnium Langsdorfii*, from Jamaica; *Frullania physantha*, from India; and *F. falciloba*, from Tasmania.

On the motion of the Chairman, a cordial vote of thanks was awarded to Mr. Boswell for his valuable gift.

Mr. William Stewart showed specimens of *Lachnella* (*Dasyscypha*) *lanariceps*, Cooke and Phil., a Discomycete found upon the rootlets of a Silver Tree-Fern (*Cyathea dealbata*) from New Zealand, now growing in the Kibble Palace, Glasgow Botanic Gardens. He stated that the species was originally described (*Grevillea*, vol. viii., p. 62) from Australian specimens gathered on *C. dealbata*; but since then no instance of its occurrence appears to have been placed on record. The fungus presents the appearance of a minute white cup, clothed externally with very fine downy hairs, among which are numerous little purple granules. These bodies, which seem peculiar to this species, were also observed on the original specimens from Australia, but their precise nature and function have not yet been determined. It is noteworthy that the spores of the Glasgow specimens are pseudo-septate, or 3-5-guttulate—a peculiarity not observed in the Australian fungus. This, however, may be due to the latter having been kept for some time before being subjected to microscopic examination, as such markings have in similar circumstances been known to become indistinct or even obliterated.

Mr. John Smith, Corresponding Member, communicated a paper on "English Upper Silurian Ostracoda,"* in illustration of which a fine series of specimens, collected by Mr. Smith, was exhibited by Mr. D. Corse Glen, C.E., F.G.S.

Mr. David Robertson, F.L.S., F.G.S., submitted a paper on "Some Recent Marine Ostracoda dredged in Granton Harbour,"† along with a complete series of illustrative specimens.

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## 25TH FEBRUARY, 1890.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

Mr. James Steel exhibited specimens of the Barn Owl, Tawny Owl, Long-eared Owl, Short-eared Owl, and Snowy Owl.

Mr. Robert H. Read, C.E., M.B.O.U., gave an interesting account of the distribution and habits of these and other British species of Strigidæ. He showed a specimen of the Tawny Owl, *Strix stridula*, L., trapped in the woods near Luss, and remarkable for its grey plumage; also four eggs of this species taken at Dumfries, two of which were of the ordinary size and two considerably larger than usual; and a still larger

* *Transactions*, vol. iii., p. 134. † *Ibid.*, p. 196.

egg, lent by Mr. Henry M'Culloch, who had taken it from the body of a bird in the process of being stuffed. Remarks on these birds and eggs were made by the Chairman, Mr. Theodore Walker, Mr. George Russell, and others.

Mr. James J. F. X. King exhibited specimens of *Diplax striolata*, Charp., and *Æschna juncea*, L., two species of Dragon-flies captured at the lantern of Blackrock Lighthouse, County Mayo, Ireland.

The Chairman (Mr. Somerville) showed specimens of *Cephalanthera ensifolia*, Rich., from King's Cross, Arran, and *Hieracium aggregatum*, Backh., from Ben More, Perthshire.

Mr. Peter Ewing, Vice-President, showed specimens of the following new or little-known British plants:

*Ranunculus trichophyllus*, Chaix, var. *demersus*.—Kilpatrick Hills (*L. Watt*).

*Hieracium vulgatum*, Fr., var. *rubescens*, Backh.—Gleann Asdale, Jura; July, 1889 (*P. Ewing*).

*H. lingulatum*, Backh.—Ben Lomond; August, 1888 (*P. Ewing*).

*H. sparsifolium*, Lindb.—Gleann Asdale, Jura; July, 1889 (*P. Ewing*).

*Luzula albida*, DC.—Overtoun, Dumbartonshire; July, 1889 (*L. Watt*).

*Carex panicea*, L., var. *tumidula*.—Loch nam Ban, Islay; July, 1889 (*P. Ewing*).

Mr. D. A. Boyd showed specimens of *Leptothyrium rubi* (Duby) Sacc., a fungus found on dead leaves of Bramble in the neighbourhood of West Kilbride, but not observed elsewhere in Scotland.

A paper entitled "Meterological Notes for 1889, and Remarks on Temperature, Vegetation, etc., as recorded in the Royal Botanic Gardens, Glasgow," was submitted by Mr. Robert Bullen, Curator.

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## 25th March, 1890.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

Mr. James Macaulay, Royal Bank of Scotland, Maryhill, was elected an Ordinary Member.

Mr. D. A. Boyd exhibited a head of a mummied Cat from Beni-Hasan, Central Egypt. He stated that an enormous deposit of cat-mummies, recently discovered at Beni-Hasan, had been acquired by an enterprising firm of merchants in Liverpool and brought over to this country to be ground into manure. Beni-Hasan is famed for its rock-tombs, thirty in number, which are among the most ancient and interesting of Egyptian monuments. In the neighbourhood was a celebrated temple dedicated to the worship of the goddess Pasht, who is

represented on the sculptured monuments as a cat-headed female figure, and is believed to have been the same deity as the lion-headed goddess Bast. Mr. Boyd referred to the various theories which have been held regarding the origin of the so-called "animal-worship" of Egypt and other countries, and indicated that such veneration for particular animals was probably to be traced to totemism during prehistoric times.

The Chairman read a communication which had been forded by Professor W. A. Herdman, D.Sc., F.R.S.E., F.L.S., Liverpool, Corresponding Member, who stated that when these mummies arrived in Liverpool they were all in a fragmentary state. The cat-heads were in various conditions, some being shapeless masses thickly coated with bitumen, others having fragments of the mummy-cloth still wrapped round them, and others again being simply dried, the fur (in all cases of a yellowish colour) being present, and the ears, nose, and vibrissæ perfect. The integument and subjacent tissues had been successfully stripped off several of the dried specimens, so as to produce fairly good skulls which could be measured and compared with those of their probable descendants, our present domestic cat. The Egyptian skulls were about one-fifth larger than those of our present cat. Taking the latter as being on an average 100 mm. in length, then the average length of the mummy skulls would be nearly 120 mm.; and this greater size was almost entirely in the anterior region, in front of the coronal suture. In the domestic cat, from occipital crest to coronal suture was about 48 mm., and from coronal suture to premaxillary symphysis 52 mm., while in the mummy cats the same measurements were 50 and 70 respectively. The jaws, both upper and lower, were larger and stronger in the mummies than in the domestic cat, and the zygomatic arch was fully one-fifth wider, the numbers being 30 mm. and 24 mm. respectively. The ancient Egyptian cats were thus notably larger in the facial region, the jaws, and the zygomatic arch. In regard to the species of the cat-remains, it is said that four out of the fifty so-called species of *Felis* have been found mummied in Egypt, viz., *F. chaus* (the jungle cat of India), *F. bubastes*, *F. caligata*, and *F. maniculata* (the gloved cat). It seemed very doubtful that the true *F. chaus* of India had been found in Egypt, and no satisfactory account could be obtained of *F. bubastes*, while *F. maniculata* of Rüppell was apparently synonymous with *F. caligata*, to which species the specimens from Beni-Hasan probably belonged.*

Mr. R. Broom, M.B., C.M., B.Sc., stated that *Felis maniculata* still exists in a wild state in the valley of the Nile. He

* See *Trans. Biol. Soc. Liverpool*, vol. iv., p. 95.

showed, for comparison with the mummied head, several skulls of *F. domestica*, and made some remarks on their morphological features.

Mr. George Russell exhibited a raceme of *Dendrobium nobile*, Lindl., having the flowers abnormally developed on the stem. A similar specimen was exhibited by Mr. Peter Ewing, Vice-President, who made some remarks on the probable cause of the abnormality.

Mr. Johnston Shearer showed a piece of Paper made from the inner bark of a tree in the Shan Country of Upper Burmah, and gave an account of the process of manufacture.*

Mr. D. A. Boyd showed specimens of *Phoma laminariæ*, C. & M., a fungus recently described in *Grevillea* by Messrs. Cooke and Massee. It occurs in spring on decaying and half-bleached fronds of *Laminaria digitata* which have been cast ashore during the storms of winter and stranded above the ordinary tide-mark. The fungus seems to be abundant on the Ayrshire coast near West Kilbride.

Mr. Boyd also showed examples of *Glœosporium cinctum*, B. & C., a fungus discovered by Mr. George Russell on dead leaf-tips of *Dendrobium*, *Odontoglossum*, *Miltonia*, and other exotic orchids at Redlands, Kelvinside, and by Mr. Boyd in the Glasgow Botanic Gardens. Specimens have been submitted to Dr. M. C. Cooke, who has pronounced the species new to Britain.

Mr. David Robertson, F.L.S., F.G.S., submitted a paper on the "Habits of a Hedgehog (*Erinaceus europæus*) in Domestication." †

Mr. R. Broom, M.B., C.M., B.Sc., stated that personal observation had established the fact that the female Hedgehog occasionally devours her offspring.

Mr. C. O. Sonntag remarked that in Germany it is often said that the Hedgehog cannot be poisoned. In one instance, which came under his own observation, a Hedgehog seemed to sustain no injury from a strong dose of arsenic sufficient to kill a much larger animal. In some parts of Switzerland, Northern Italy, etc., the skin of the animal is used by the poorer classes for the manufacture of caps.

The following papers were read:

"The Land and Fresh-water Mollusca of Bute," by Mr. Thomas Scott, F.L.S., Corresponding Member. ‡

"Notes on the Rarer Plants of the Parish of Old Kilpatrick," by Mr. L. Watt. §

* *Transactions*, vol. iii., p. 256. † *Ibid.*, p. 193. ‡ *Ibid.*, p. 170. § *Ibid.*, p. 182.

29TH APRIL, 1890.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

Messrs. Gavin M. Pratt, 104 West Graham Street, and John Rennie, Wellcroft, Helensburgh, were elected Ordinary Members.

Mr. Thomas Scott, F.L.S., Corresponding Member, exhibited specimens of *Metridia armata*, Boeck, and *Candace pectinata*, Brady, both recently dredged by him in the Firth of Forth.

Mr. James J. F. X. King, F.E.S., exhibited a series of Lepidoptera from Unst, Shetland, showing some remarkable colour-variations. Side by side were placed for comparison typical examples of the various species represented, viz.: *Charæas graminis*, L., *Larentia cæsiata*, Lang, *Emmelesia albulata*, Schiff., *Melanippe montanata*, Bork., *Coremia munitata*, Hb., *Pamplusia mercuriana*, Hb., and *Aphelia osseana*, Scop.

The Chairman (Mr. Somerville) exhibited a small collection of Flowering-plants from Mingulay, the furthest outlying island of the Outer Hebrides group. He stated that the collection had been formed by Mr. John Finlayson, Teacher on the island. It included 74 species, 4 of which—viz.: *Cochlearia anglica*, L., *Sonchus arvensis*, L., *Stachys arvensis*, L., and *Polygonum aviculare*, L., var. *arenastrum* (Bor.)—had been found to be new records for the Watsonian Vice-county No. 110 to which the Outer Hebrides belong. Some discussion took place on the importance of inducing school-children and young persons residing in such remote localities to form collections of plants and similar objects. It was suggested that if suitable prizes were offered, the competitive collections submitted would afford a means of amplifying the meagre information which exists regarding the plants, shells, etc., of the more remote islands.

Mr. Johnston Shearer exhibited specimens of *Ledum palustre*, L., an addition to the Flora of Great Britain, and communicated some notes on its discovery in Stirlingshire and Perthshire. *

Mr. L. Watt exhibited specimens of the following plants from Dumbartonshire, and new records for Vice-county No. 99, viz.:

*Sisymbrium Sophia*, L.—Cardross.

*Subularia aquatica*, L.—Inch-Cailliach, Loch Lomond.

*Hieracium auratum*, Fr.—Inversnaid.

*H. Eupatorium*, Griesbach (*H. corymbosum*, Fr.).—Inversnaid.

*Sparganium minimum*, Fr.—Moors above Helensburgh.

*Carex Œderi*, Ehrh., var. *minor*, Townsend.—Head of Loch Long, Arrochar.

Professor Thomas King exhibited specimens of *Lathræa squamaria*, L., from Cambuslang and Strathblane.

Mr. Henry Boswell, Corresponding Member, submitted specimens of 11 exotic Mosses, viz.: *Pilopogon gracilis*, from

* *Transactions*, vol. iii., p. 251.

Guadaloupe; *Cyathophorum pennatum*, from New Zealand; *Syrrhopodon fasciculatus*, from Pitcairn Island; *S. lycopodioides*, from Jamaica; *Neckera rugulosa*, from Ceylon; *Meteorium amœnum*, from Ceylon; *M. cerinum*, from Tasmania; *Pilotrichum procerum*, from Guadaloupe; *Ectropothecium amphibolum*, from Guadaloupe; *Echinodium hispidum*, from Tasmania; and *Hypnum admistum*, from Jamaica.

The Secretary stated that these specimens had been presented by Mr. Boswell to the Society, and on the motion of the chairman a cordial vote of thanks was awarded to the donor.

Mr. D. A. Boyd showed specimens of the following Fungi recently described in *Grevillea* by Messrs. Cooke and Massee from examples gathered in the same localities as the specimens exhibited, viz.:

*Volutella citrina*, C. &. M.—On dead stalks of *Trollius* at Seamill, Ayrshire.

*Glœosporium elasticum*, C. & M.—Discovered by Mr. C. Sherry on dead leaves of *Ficus elastica* in the Botanic Gardens, Glasgow.

Mr. David Robertson, F.L.S., F.G.S., reported the recent occurrence of the Greater Fork Beard, *Phycis blennoides* (Brün.), in the Firth of Clyde."*

The following papers were read:

"Notes on *Gastropteron Meckelii*, Kosse," by Mr. Edgar A. Smith, F.Z.S., Corresponding Member.†

"Third Contribution to the Topographical Botany of the West of Scotland," by Mr. Peter Ewing, Vice-President.‡

* *Transactions*, vol. iii., p. 267. † *Ibid.*, p. 258. ‡ *Ibid*,. p. 161.

NATURAL HISTORY SOCIETY OF GLASGOW.

## *ABSTRACT STATEMENT OF ACCOUNTS FOR SESSION 1888-89.*

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| 1888.—Sept. 1. | | | | | | |
| To Cash in National Security Savings Bank, | £128 | 0 | 2 | | | |
| Less due to Treasurer, | 5 | 12 | 3½ | | | |
| | | | | £122 | 7 | 10½ |
| 1889.—Aug. 31. | | | | | | |
| To 259 Members' Annual Subcriptions @ 7s. 6d., | | | | 97 | 2 | 6 |
| „ 8 Life Members' „ @ £5 5s., | | | | 42 | 0 | 0 |
| „ 42 Members' Entry-money @ 7s. 6d., | | | | 15 | 15 | 0 |
| „ 7 Members' Arrears, | | | | 3 | 0 | 0 |
| „ 14 Associates' Subscriptions @ 2s. 6d., | | | | 1 | 15 | 0 |
| „ Donation, | | | | 5 | 0 | 0 |
| „ Donations towards Expenses of Lectures, | | | | 23 | 10 | 6 |
| „ *Proceedings*, etc., sold, | | | | 2 | 10 | 8½ |
| „ Interest, | | | | 3 | 17 | 2 |
| | | | | £316 | 18 | 9 |

| | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|
| 1889.—Aug. 31. | | | | | | |
| By Rent and Attendance, | | | | £6 | 6 | 0 |
| „ Postage, Stationery, etc., | | | | 18 | 9 | 1 |
| „ Printing *Proceedings*, Circulars, etc., | | | | 84 | 3 | 3 |
| „ Library—Additions, | | | | 7 | 3 | 4 |
| „ „ Binding, | | | | 6 | 0 | 6 |
| „ „ Insurance,* | | | | 0 | 6 | 0 |
| „ „ Postage, Carriage, etc., | | | | 3 | 17 | 3 |
| „ Lectures, | | | | 23 | 1 | 1 |
| „ Invested in Debentures of Modern Permanent Building and Investment Society, Melbourne, | | | | 100 | 0 | 0 |
| „ Balance in National Security Savings Bank, | £73 | 0 | 1 | | | |
| Less due to Treasurer, | 5 | 7 | 10 | | | |
| | | | | 67 | 12 | 3 |
| | | | | £316 | 18 | 9 |

*This covers the Books, Book-cases, etc., insured to the extent of £300.

GLASGOW, 18*th October*, 1889.—We have examined the Books for the year 1888-89, and have compared the Vouchers, and find them correct, the sum in the National Security Savings Bank being Seventy-three Pounds and One Penny, and the Balance due to the Treasurer Five Pounds Seven Shillings and Tenpence.

D. PEARSON,
THOS. G. BISHOP, } *Auditors.*

## SUMMER SESSION, 1890.

### 20TH MAY, 1890.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Donald Farquhar reported on an Excursion made to Overton, near Dumbarton, on 17th inst., and stated that 86 plants had been seen in flower.

On behalf of Mr. Henry Grieve, the Chairman exhibited a specimen of *Zamites Leggettii*, a fossil Cycad from Rosario, Spanish Honduras.

Mr. John Renwick exhibited specimens of *Paris quadrifolia*, L., from Glenny, Lake of Menteith, and remarked that in a book descriptive of Inchmahome (one of the islands in the lake) and its surroundings, published by the Rev. W. Macgregor Stirling in 1815, it was stated on the authority of Rev. Dr. Graham, Aberfoyle, that *Paris* was found "in the glen of Glenny in great plenty," and was not known to Dr. Graham "to grow anywhere else in Scotland except in the Den of Balthayock near Perth, and on the braes of Cathcart near Glasgow."

Mr. Renwick also showed specimens of *Peucedanum Ostruthium*, Koch, from Talla, an island in the Lake of Menteith, and reported that he had seen *Typha latifolia*, L., in a pond on the estate of Cardross in the same district, where it was introduced from Talla by a former gardener at Cardross. In Mr. Stirling's work, already cited, Dr. Graham stated that *Typha* grew "on the south-east shore of Talla," but did not know of its occurrence in any other lake in the vicinity. In a note, the editor adds: "It is also on the banks of a stream that flows out of the Lake of Inchmahome." The stream referred to is the Guidie, or Goodie.

When visiting the district last spring, Mr. Renwick found *Paris quadrifolia* still abundant in the Glenny glen; and what appeared to be last year's stems of *Typha latifolia* were seen off Talla, but the latter plant was not observed at the mouth of the Guidie.

Professor Thomas King showed a specimen of *Morchella conica*, Pers., a fungus found near Airdrie by Mr. Robert Dunlop; and he stated that an example had been submitted to Mr. William Phillips, F.L.S., Corresponding Member, for verification.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, exhibited specimens of the Jew's-ear (*Hirneola Auricula-Judæ*, L.), found

by the Rev. J. E. Somerville, B.D., on a lemon-tree in a garden at Mentone.

Mr. R. Broom, M.B., C.M., B.Sc., exhibited a series of microscopic specimens illustrating the peculiar proliferation of epithelium in the jaws of fœtal mammalians. In the course of some remarks on the specimens, he attempted to prove that the structure represented the remains of a horny beak possessed by the ancestors of the Mammalia, and still found in the Duck Mole (*Ornithorhynchus anatinus*, Shaw) of Australia. This beak is similar in character to that of the tadpole and tortoise, and seems to be a survival of the beak which was undoubtedly present in many of the Triassic Reptilia, which are generally recognised to have been the immediate ancestors of the Mammalia.

The remainder of the evening was devoted to the exhibition of numerous other microscopic objects.

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3rd June, 1890.

Professor Thomas King in the Chair.

Mr. John Renwick reported on an Excursion made to the Stirling district on 31st May, under the leadership of Mr. Robert Kidston, F.R.S.E., F.G.S. The party included a few members of the Stirling Natural History and Archæological Society. The glen of the Bannock Water, south of Gillies Hill, was visited, and the botanical and geological features of the district were inspected. Many very fine thorn and alder-trees were seen in the course of the excursion.

Mr. James J. F. X. King, F.E.S., exhibited specimens of *Noctua glareosa*, E., from Barnsley, and also from Unst, Shetland. The latter were remarkable for their very dark colour, the ground being almost as dark as the markings, giving the insect an appearance very different from its usual aspect. Mr. King also showed specimens of *Celæna Haworthii*, C., from the neighbourhood of Glasgow, and also from Unst. The latter, although not differing much in colour from the usual form, were little more than half the ordinary size.

The Chairman exhibited specimens of *Cerastium semidecandrum*, L., from Tollcross, and reported that *Rubus Chamæmorus*, L., had been found by Mr. Thomas B. Wilkie on Inchmoan, one of the islands in Loch Lomond.

Mr. R. Turner, Vice-President, exhibited specimens of *Spiræa opulifolia*, DC., from the neighbourhood of Milngavie.

Mr. John Renwick showed specimens of *Scutellaria minor*, L., from Inch-Cailliach, Loch Lomond.

17th June, 1890.

Professor Thomas King in the Chair.

Mr. John Renwick reported on an Excursion made to Killermont on the evening of 10th inst. Many of the larger trees were measured; and among these were a Beech (*Fagus sylvatica*) measuring 14 ft. 5½ in. in girth at a height of 5 ft. 6 in. from the ground; a Willow (*Salix alba*), 13 ft. 6½ in. at 2 ft. 6 in.; an Ash (*Fraxinus excelsior*), 11 ft. 5 in. at 5 ft.; and a Birch (*Betula alba*), 5 ft. 10½ in. at 4 ft. 9 in. Specimens were also seen of *Typha latifolia*, L., taken from the River Kelvin, which flows through the grounds.

Mr. Renwick also reported on an Excursion made on 14th inst. to Lee, near Lanark. There also measurements were taken of many very large trees. Among these was the celebrated "Pease" Tree, a very fine Oak (*Quercus Robur*) measuring 23 ft. 7½ in. in girth at a height of from 3-4 feet from the ground.* The other noteworthy trees included two Beeches (*Fagus sylvatica*), respectively 15 ft. 4 in. at 5 ft. 1 in., and 15 ft. 3 in. at 4 ft. 9 in.; two Sycamores (*Acer Pseudo-platanus*), respectively 13 ft. 10 in. at 5 ft. 3 in.; and 13 ft. 7 in. at 5 ft.; a Larch (*Larix europæa*), 11 ft. 10 in. at 4 ft. 6 in.; and a Cedar-of-Lebanon (*Cedrus Libani*), 7 ft. 9½ in. at 5 ft. 3 in., with a spread of 43 ft. 7 in. from E.N.E. to W.S.W. On the way from Lanark Railway Station to Lee, a sparrow was seen picking at an object on the roadside. This was found to be a female cockchafer (*Melolontha vulgaris*, Latr.), a beetle rarely observed in the district.

Mr. Renwick exhibited specimens of *Aquilegia vulgaris*, L., from the garden of Mr. Alexander Sweet, Cathcart. The flowers showed various abnormalities. In some the spurs had entirely disappeared, so that the flower presented the appearance of an anemone; in others several spurs exhibited the structure of "hose in hose;" while in others the stamens were transformed into ordinary spurred petals.

The Chairman exhibited the fruit of the Loquat (*Eriobotrya japonica*, Lindley). He made some remarks on its structure, and drew attention to the comparatively large size of the seeds.

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1st July, 1890.

Mr. Peter Ewing, Vice-President, in the Chair.

Mr. Thomas Boyle reported on an Excursion made to Cathkin on the evening of 24th June. *Clematis Vitalba*, L., was found still to grow in the woods at Stonelaw, as reported by Hennedy;

* This is one of the largest Oaks in the South-West of Scotland, and rivals the famous "Capon" Tree at Jedburgh. See also measurements of large Oak at Strathleven, noted on p. lv.

and the moss *Gymnostomum tenue*, Schrad., was also seen in its well-known station on sandstone rocks at Stonelaw. Owing to the fall of part of the rock, and other changes, the area of growth of the latter plant has now been considerably restricted.

Professor Thomas King reported on an Excursion made to Inverkeithing on 28th June, under the leadership of the Rev. A. S. Wilson, M.A., B.Sc. Among the plants observed were *Thalictrum flexuosum*, Reichb., *Diplotaxis tenuifolia*, DC., *Reseda lutea*, L., *R. Luteola*, L., *Viola hirta*, L., *V. canina*, L., *Geranium sanguineum*, L., *Trifolium arvense*, L., *Astragalus glycyphyllos*, L., *Spiræa Filipendula*, L., *Potentilla reptans*, L., *Rosa Sabini*, Woods, *R. villosa*, L., *Conium maculatum*, L., *Carduus pycnocephalus*, Jacq., *Crepis biennis*, L., *Lycopsis arvensis*, L., *Echium vulgare*, L., *Scrophularia aquatica*, L., *Phleum arenarium*, L., *Avena pratensis*, L., and *Kœleria cristata*, Pers.

Mr. W. A. Dobie exhibited specimens of *Centaurea Scabiosa*, L., and *Rhinanthus major*, Ehrh., from Elie, Fifeshire.

Mr. Johnston Shearer showed specimens of *Ranunculus Lenormandi*, F. Schultz, and *Claytonia alsinoides*, Sims, from Castle Semple.

Professor King exhibited the fruit of the Almond in a green state, and made some remarks on its structure, pointing out that the tough leathery covering corresponds to the soft portion of the fruit of the Peach.

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### 12th August, 1890.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. Richard M'Kay reported on an Excursion made on the evening of 8th July to the beautifully wooded estate of Garscube. A very fine example of *Clematis Vitalba*, L., with stems measuring about five inches in diameter, was seen reaching to the top of a lofty tree.

Mr. William Stewart submitted a list of the fungi observed in the woods at Garscube. Among the more interesting species were *Agaricus* (*Flammula*) *sapineus*, Fr., *A.* (*Flammula*) *scambus*, Fr., *A.* (*Inocybe*) *rimosus*, Bull., *Russula integra*, Fr., and *Boletus subtomentosus*, L.

Mr. Peter Ewing, Vice-President, reported on an Excursion made to the Tyndrum district on 18th July and three following days. Owing to the state of the weather during the former part of the season, the earlier alpine plants were mostly past the flowering stage, while the later ones had been considerably retarded. The first day was spent on Cam Chreag, a hill north-west of Ben Challum, having two corries with a north-eastern exposure.

The rocks at their head are not very extensive, but seemed worthy of fuller exploration. The most conspicuous plants were *Dryas octopetala*, L., *Bartsia alpina*, L., and *Salix lapponum*, L., which generally indicate the presence of a rich alpine flora. *Carex vaginata*, Tausch, and *C. capillaris*, L., were abundant, with a few species of *Poa*; but *P. alpina*, L., which is usually common in such places, was not seen. Beinn Doireann was also visited, but proved to be comparatively barren.

Mr. Richard M'Kay reported on an Excursion made to Troon on 26th July. *Goodyera repens*, R. Br., was observed in Fullarton Woods, near the railway station; and on the ballast-bank numerous plants were found, including *Diplotaxis muralis*, DC., *Senebiera didyma*, Pers., *S. Coronopus*, Poir., *Crambe maritima*, L., *Hieracium umbellatum*, L., *Stachys arvensis*, L., and *Sclerochloa loliacea*, Watson.

Mr. John Renwick reported on an Excursion made to Rossdhu, Luss, on 9th inst. Mr. Richard M'Kay stated that the most interesting plants seen were *Nymphæa alba*, L., *Lobelia Dortmanna*, L., *Lysimachia vulgaris*, L., and *Sparganium minimum*, Fr., the two last-named species being plentiful.

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### 26th August, 1890.

Mr. Peter Ewing, Vice-President, in the Chair.

Professor Thomas King reported on an Excursion made to Cleghorn and Lanark on 23rd inst. Some of the party followed the course of the Mouse Water from Cleghorn Mill to Cartland Crags, while others proceeded to Lanark and visited the Exhibition recently opened for a few weeks in that town. Among the plants observed were *Cardamine amara*, L., *Helianthemum vulgare*, Gærtn., *Vicia sylvatica*, L., *Agrimonia Eupatoria*, L., *Conium maculatum*, L. (on roadside near Lanark), *Galium boreale*, L., *Cnicus heterophyllus*, Willd., *Jasione montana*, L., *Campanula latifolia*, L., *Pyrola minor*, Sw., *Origanum vulgare*, L., *Calamintha Clinopodium*, Benth, and *Epipactis latifolia*, Sw.

Mr. C. O. Sonntag read a paper on "Desmids and allied forms," in which an interesting account was given of the morphology and life-history of these plants, and the best method of collecting them. A large number of illustrative specimens were afterwards exhibited under the microscope.

## WINTER SESSION 1890-91.

### 30th September, 1890.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. W. Adam, 31 Jamaica Street, was elected an Ordinary Member.

The Chairman reported that the closing Excursion of the Summer Session had been made on 20th inst. to Strathleven, near Dumbarton. The largest trees measured were an Oak (*Quercus Robur*), 23 ft. 5 in. in girth at a height of 2 feet 6 in.; an Ash (*Fraxinus excelsior*), 12 ft. 2½ in. at 6 ft.; two Beeches (*Fagus sylvatica*), respectively 15 ft. 5½ in. at 5 ft. 6 in., and 14 ft. 10 in. at 6 ft.; a Lime (*Tilia Europæa*), 16 ft. 2 in. at 4 ft. 6 in.; a Wych Elm (*Ulmus montana*), 14 ft. 8 in. at 4 ft. 6 in.; and a Walnut (*Juglans regia*), 11 ft. 3½ in. at 3 ft.

Mr. Robert H. Read, C.E., M.B.O.U., exhibited a very fine series of British Falconidæ and their eggs, and a set of beautifully coloured plates of these birds now being published by Lord Lilford. He described the characteristics of the genera and species which occur in Britain, whether as permanent residents or casual visitors, and gave an interesting account of their habits.

Mr. James Steel showed specimens of *Vertigo pusilla*, Müll., found by him between Cleghorn and Lanark, and stated that this mollusk had previously been only once recorded for Scotland.

Mr. David Robertson, F.L.S., F.G.S., exhibited a six-rayed specimen of *Uraster glacialis*, Linn, taken in about six feet of water off the east side of the Castle, Little Cumbrae.*

Mr. John Renwick reported the occurrence of *Lactuca muralis*, L., at Clynder, Gareloch.

Professor Thomas King exhibited fruiting specimens of various plants from the Boat of Garten district, including *Vaccinium Vitis-Idæa*, L., *Arctostaphylos Uva-ursi*, L., *Empetrum nigrum*, L., *Juniperus communis*, L., and *Hypnum crista-castrensis*, L.; also branches of *Juniperus communis* having the terminal buds swollen into a gall through the agency of *Hormomyia juniperina*, L., a dipterous insect.

Mr. Johnston Shearer showed an extensive collection of alpine plants gathered last July in the Tyndrum district.

Mr. William Stewart gave an interesting account of the Conference and Excursions of the Cryptogamic Society of Scotland,

* *Transactions*, vol. iii., p. 269.

recently held at Boat of Garten; and he showed a large number of fungi from that district. Among the rarer species exhibited were *Agaricus* (*Amanita*) *virosus*, Fr., *A.* (*Armillaria*) *bulbiger*, A. & S., *A.* (*Flammula*) *spumosus*, Fr., *Paxillus atrotomentosus*, Fr., *Cantharellus umbonatus*, Fr., *Hydnum imbricatum*, L., *H. fragile*, Fr., and *H. scrobiculatum*, Fr.

Rev. James Keith, LL.D., Corresponding Member, sent for exhibition some fine specimens of *Polyporus Schweinitzii*, Fr., a fungus which grows in imbricated masses of a rich chestnut colour among roots of old trees in pine forests in the Forres district.

Professor James W. H. Trail, M.D., F.R.S.E., F.L.S., Corresponding Member, sent for exhibition some specimens of *Peziza* (*Tarzetta*) *ammophila*, Dur. and Mont., found among roots of *Ammophila arundinacea* on the sea-shore north of the mouth of the River Don, near Aberdeen.

Mr. Robert Turner, Vice-President, read some notes communicated by Mr. David Gregorson, California (formerly a member and office-bearer of the Society), on the Black Scale, *Lecanium oleæ*, Bernard, an insect-parasite which affects the branches and leaves of the olive and oleander, and the branches and twigs of pepper-tree, apricot, pomegranate, orange, lemon, lime, and guava. An interesting account was given of observations made by Mr. Gregorson on the hatching of the eggs and development of the young insects, and reference was made to various methods of destroying this parasite by spraying the branches of the trees on which it occurs. In some instances as many as 95 per cent. of the scales were killed in this way, with very trifling damage to the growing fruit. Of the preparations used, a solution of pearl-ash and resin was found to be most effective, and least injurious to the trees. A solution of caustic-soda, resin, and whale-oil seemed to have a tendency to defoliate the trees, although that result might have been partly due to the spray having been applied during hot sunshine or drying wind. The best period for spraying was as soon as possible after the middle of September, when the old insects had disappeared and the young ones were fully hatched out. While a strong solution, applied earlier, would kill the old scale as well as the young, it would be more apt to injure the tree; but a weaker solution, applied at the time recommended, would be quite effective on the young without any danger to the tree. Mr. Gregorson believed that twice spraying —first about the middle of August, and afterwards about the end of September—would render the work of destruction more effective. When present in large numbers, the scale does considerable injury by causing the prevalence of a smutty fungus which grows on the sticky exudation either from the

leaves or from the insects themselves. It blackens the leaves, and so retards the beneficial influences of light and air; and the fruit, although not actually injured in quality, is blackened and rendered unsaleable. The tree would, of course, be more or less injured, and its vitality sapped, if the young insects were prevalent all over its leaves.

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## THE THIRTY-NINTH ANNUAL GENERAL MEETING.

28TH OCTOBER, 1890.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair. The Secretary (Mr. D. A. Boyd) read the

### REPORT OF THE COUNCIL.

*Membership.*—During the past year the names of 9 Ordinary Members were added to the Roll. The present membership is as follows:

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|---|---|---|
| Honorary, | | 15 |
| Corresponding, | | 43 |
| Ordinary: | | |
| Life Members, | 29 | |
| Annual, | 260 | |
| Suspended, | 11 | |
| | | 300 |
| Total Membership, | | 358 |

4 Associates were elected, the number on the Roll now being 19.

*Meetings and Excursions.*—Eight Meetings were held during Winter-Session 1889-90, at which a large number of zoological and botanical specimens were exhibited, and various important communications read. Reports of the Meetings were supplied to the local newspapers.

During the winter the Council had under consideration various suggestions which had been made with the view of rendering the Summer Meetings and Excursions of more interest and value to the members than in recent years, and a Committee was accordingly appointed to make and carry out the necessary arrangements for these Meetings and Excursions. Special thanks are due to the Committee for the very complete and satisfactory provisions made by them for the Excursions, especially in obtaining permission for the Society to visit private estates not usually accessible to the public, and in making arrangements for the stoppage of trains, and for the issue of tickets at a reduced rate to members attending the Excursions.

Seven Meetings were held during the Summer Session, at which reports on Excursions were submitted, numerous specimens exhibited, and short papers read. An Exhibition of Microscopic Objects took place at the meetings on 20th May and 26th August.

Sixteen Excursions were made, as follows: 17th May, Overtoun; 31st May, Stirling; 10th June, Killermont; 14th June, Lee; 24th June, Cathkin; 28th June, Inverkeithing; 8th July, Garscube; 18th July, Tyndrum; 26th July, Troon; 9th August, Luss and Rossdhu; 16th August, Keir and Lecropt; 23rd August, Cartland Crags; 6th September, Edinbarnet; 13th September, Glen Massan; 20th September, Strathleven; and 4th October, Killermont.

The Council regret to report that the attendance at the Excursions last summer could not be regarded as satisfactory, and was especially disappointing to the Summer Committee, in view of the great care taken by them in making most advantageous arrangements. It may not be inappropriate to remind the members that these Excursions afford favourable opportunities for the study of Field Botany such as are not usually available to solitary workers; while beginners may often acquire more practical instruction from attending a single Excursion than can be attained by many days of unaided study, as they may secure the assistance of experienced botanists whose knowledge will at once resolve many apparent difficulties in the determination of genera and species. Besides, an Excursion may be rendered permanently useful if careful observations be noted of the animals and plants seen, and the utility of this work becomes much enhanced when the attendance is so large as to enable such observations to cover a wide range of departments of zoology and botany.

*Council.*—Fourteen Meetings of Council were held between 24th September, 1889, and 19th September, 1890.

In response to numerous suggestions which have been made from time to time regarding the more efficient working of various departments of the Society's business, the Council have framed Bye-Laws giving effect to such suggestions and proposals as seemed practicable and worthy of adoption. These Bye-Laws, which were adopted at a meeting held on 3rd June, while relating chiefly to the work of the Council, and to the departments of the Society's affairs under the charge of individual Office-Bearers, provide *inter alia* for the appointment annually in November of the following Committees to undertake certain specified duties: (1) Museum Committee, (2) Research Committee, (3) Summer Committee, (4) Publishing Committee, (5) Library Committee, (6) Photographical Committee, and (7) Microscopical Committee. Particulars of the

membership and work of these Committees will be duly intimated to the Society by circular.

*Proceedings and Transactions.*—Two parts have been issued during the year, viz., Vol. II., Part 2, relating to the work of Session 1887-88, and containing Index to Vol. II.; and Vol. III., Part 1, relating to the work of Session 1888-89.

Vol. III., Part 2, is now in the hands of the printer.

*Donations.*—Grateful acknowledgment is made of various gifts received during the past year, including (1) "*Compt-rendu des Seances Congres International du Zoologie,* 1re Session, Paris, 1889," presented by the Organising Committee of the Congress; (2) *Guides to the Galleries of the British Museum* (*Natural History*), 13 vols., presented by the Trustees of the Museum; (3) 37 Specimens of Exotic Mosses and Hepatics, presented by Mr. Henry Boswell, Oxford, Corresponding Member; and (4) an extensive Herbarium of British Flowering-Plants, presented by an anonymous donor.

The Librarian (Mr. James J. F. X. King) reported as follows:

The books in the Library are in good condition, but the book-cases are becoming too small for the large number of works which are being added from time to time. Last Session the separate works received in exchange, gift, and purchase reached about 400. The Library now contains upwards of 1200 bound volumes. During the Winter Session 87 volumes were borrowed, while during the Summer Session the number reached 80. Vol. II., Part 2, and Vol. III., Part 1, of the *Proceedings and Transactions* have been forwarded to 164 Societies, Institutions, etc.

The Treasurer (Mr. John Renwick) submitted a Statement of Accounts, showing the revenue and expenditure of the Society during the year.

The Reports were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., was elected President; Mr. William Stewart, a Vice-President; Messrs. D. A. Boyd and James Steel, Secretaries; Mr. John Renwick, Treasurer; Mr. James J. F. X. King, F.E.S., Librarian; and Messrs. Robert H. Read, C.E., M.B.O.U., Peter Ewing, Johnston Shearer, Christopher Sherry, D. Corse Glen, C.E., F.G.S., and C. O. Sonntag, Members of Council—the Council being as follows: President, Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S.; Vice-Presidents, A. Somerville, B.Sc., F.L.S., Robert Turner, and William Stewart; Secretaries, D. A. Boyd and James Steel; Treasurer, John Renwick; Librarian, James J. F. X. King, F.E.S.; Members of Council, D. Corse Glen, C.E., F.G.S., C. O. Sonntag, Robert Broom, M.B., C.M., B.Sc., Thomas F. Gilmour, M.D., L.R.C.P.E., Professor Thomas King, R. S. Wishart, M.A., James Barrie

Low, M.A., David Pearson, Robert H. Read, C.E., M.B.O.U., Peter Ewing, Johnston Shearer, and Christopher Sherry.

Messrs. Thomas G. Bishop and Duncan Mackenzie were elected Auditors for the ensuing year.

Mr. Robert Edgar, M.A., 4 Kelvingrove Street, was elected an Ordinary Member.

Mr. William Gibson, 58 Taylor Street, was elected an Associate.

Professor Thomas King reported on an Excursion made to Killermont on 4th inst. *Typha latifolia*, L., was observed growing in the River Kelvin, and forty species of Fungi, including *Agaricus* (*Pleurotus*) *septicus*, Fr., and *Leotia lubrica*, Pers., were collected in the woods.

Mr. James J. F. X. King, F.E.S., exhibited a specimen of *Mecostethus grossus*, L., from Killarney. He stated that this Grasshopper, which is found in marshy places, has occurred in the Counties of Norfolk and Kerry, and that there are several examples in the British and Dublin Museums.

Professor Thomas King showed specimens of *Catabrosa aquatica*, Beauv., found near Kilmalcolm by Mr. John Thomson, Farmer, Dennistoun; and he remarked that although the typical grass is apparently very rare in Clydesdale, the variety *littoralis*, Parn., is common on the sandy shores of the Firth. Examples of var. *littoralis*, gathered in Arran, were exhibited by the Chairman (Mr. Somerville).

Professor King also submitted a specimen of *Trametes pini*, Fr., obtained on living trees of *Pinus sylvestris* at Rothiemurchus during the recent visit of the Cryptogamic Society of Scotland to that district.

Mr. D. A. Boyd showed examples of *Uredo Lynchii* (B. and Br.) Plow., a Fungus originally described from specimens obtained on living leaves of an exotic orchid (*Spiranthes*) in Kew Gardens, but not hitherto recorded for Scotland. It is interesting to notice that this parasite has been detected by Mr. George Russell on *Spiranthes* in greenhouses at Redlands, Kelvinside, and specimens have been submitted to Dr. M. C. Cooke for identification.

Mr. Boyd also showed specimens of *Glœosporium affine*, Sacc., found on dead leaves of *Hoya* and *Æschynanthus* at Redlands, and pronounced by Dr. Cooke to be new to Britain.

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25th November, 1890.

Mr. William Stewart, Vice-President, in the Chair.

Dr. M. C. Cooke, A.L.S., 146 Junction Road, Upper Holloway, London, N., was elected an Honorary Member.

Messrs. John E. Carlyle, 73 Langside Road, Crosshill; A. F. Johnston, 43 Buccleuch Street; and John Lang, 5 Frederick Lane, were elected Ordinary Members.

Mr. Thomas Scott, F.L.S., Corresponding Member, exhibited specimens of *Rhincalanus gigas*, Brady, and *Ectinosoma atlanticum*, B. and R., two copepods from the East of Scotland, upon which he made some remarks.*

Mr. Andrew Scott exhibited specimens of *Cecrops latreillei*, Leach, and *Læmargus muricatus*, Kroyer, two parasitic species of crustacea found on a short sunfish (*Orthagoriscus molæ*) from the Firth of Forth.†

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, showed specimens of *Bidens cernua*, L., gathered near Ballina, County Mayo.

Professor Thomas King showed specimens of *Vaccinium intermedium*, Ruthe, from Cannock Chase, Staffordshire, where the plant was discovered by Professor T. G. Bonney, F.R.S., in 1886. It is plentiful in certain spots where *Vaccinium Myrtillus*, L., and *V. Vitis-Idæa*, L., grow abundantly, and is believed to be a hybrid between these two species. A paper on the occurrence of *V. intermedium* in Britain was read by Mr. N. E. Brown, A.L.S., at a meeting of the Linnean Society on 5th May, 1887.

The following papers were read:

"Notes on the Littoral Fauna of Kilchattan Bay, Bute," by Mr. David Robertson, F.L.S., F.G.S.

"Botanical Notes from Wigtownshire, Kirkcudbrightshire, and Dumfriesshire, in 1890," by James M'Andrew, Corresponding Member.‡

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23RD DECEMBER, 1890.

Mr. R. Turner, Vice-President, in the Chair.

Mr. William Watson of Netherfauldhouse, Clairinch, Milngavie, was elected an Ordinary Member.

Miss C. Forbes, Kelvinside Academy, was elected an Associate.

Mr. Robert Broom, M.B., C.M., B.Sc., exhibited a series of specimens illustrating the modifications of the quadrate bone in the various groups of vertebrates. In the course of his remarks he traced the various changes in the arrangement for articulating the lower jaw, from the condition in the Shark, through the higher Fishes, to the Amphibians. He pointed out that from the Amphibians there had been two lines of descent, viz.: (first) that of the Reptiles and Birds, in which the quadrate bone had increased in size and strength; and (second) that of the Mammals, in which the quadrate had degenerated into a cartilaginous plate—the interarticular fibro-cartilage.

Mr. James J. F. X. King, F.E.S., showed some uncommon varieties of *Boarmia repandata*, L., and *Camptogramma bilineata*, L., taken by him last summer in the Loch Maree

* *Transactions*, vol. iii., p. 264. † *Ibid.*, p. 266. ‡ *Ibid.*, p. 260.

district. Typical examples of these moths were also shown for comparison.

Mr. D. A. Boyd showed specimens of *Didymium physarioides*, Fr., *Leotia lubrica*, Pers., *Sporomega cladophila*, Lev., and other fungi from the West Kilbride district. Sections illustrating the asci, sporidia, and paraphyses of *Geoglossum difforme* and *Leotia lubrica*, were exhibited under the microscope.

Mr. Robert H. Read, C.E., M.B.O.U., read a paper on "The Nesting Habits of some resident British Ducks," illustrated with specimens of the birds, and examples of nests and eggs recently obtained in Scotland.

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## 28th January, 1891.

Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., President, in the Chair.

The Secretary (Mr. D. A. Boyd), referred to the loss which the Society had sustained in the death of Mr. Adolf Paul Schulze, F.R.S.E., F.R.M.S., which took place on 3rd inst. He moved, and it was unanimously resolved that a memorial notice of Mr. Schulze should be recorded in the minutes, and a copy thereof transmitted to Mrs. Schulze, with an expression of the sympathy of the Members of the Society with her and her family in their bereavement.

### *IN MEMORIAM*—Adolf Paul Schulze, F.R.S.E., F.R.M.S.

Mr. Schulze was born on 8th October, 1840, at Crimmitschau, in Saxony. He was educated at the Burgerschule in that town, at a similar school at Mohl, near Zwickau, and at the Polytechnic at Chemnitz. He studied engineering at Chemnitz for about four years, and came to England in 1864, when he obtained the position of draughtsman to Messrs. Pratchett, Blaylock and Pratchett. In 1866 he joined his brother in business in Manchester as a yarn merchant, and settled in Glasgow in 1869.

While well known in business circles, his high scientific attainments were widely recognised and appreciated. In a great commercial centre such as our own, comparatively few men immersed in the daily cares of business life find time, or even have the inclination, to devote their leisure hours to the cultivation of a department of science, and fewer still are able to prosecute such studies with the unflagging energy necessary to insure an eminent degree of success. But no desire of mere amusement or recreation marked his devotion to his favourite pursuit. An intense love of research enabled him to find the keenest pleasure in laborious investigations, while his great capacity for such work, and habits of scrupulous accuracy, rendered these investigations of permanent value to science.

Mr. Schulze's special study was the microscope considered as an optical instrument. He was thus deeply interested in all its improvements, as well as in the newest methods of microscopical research, and was usually the first to introduce new lenses and optical appliances to the notice of Glasgow microscopists. To his great enthusiasm was added a faculty of lucid explanation which enabled him readily to impart information regarding the most minute details of optical science; while the value of his opinion and criticism was greatly appreciated at home and abroad. He possessed the highest skill in microphotography; and examples of his work in this department, almost unsurpassed as affording perfect representations of some of the most minute test-objects, have been exhibited at meetings of our own and other local Societies. He also made numerous substantial contributions to microscopical science in the form of papers to scientific journals and the Transactions of various learned Societies with which he was connected.

Mr. Schulze was a Fellow of the Royal Society of Edinburgh, a Fellow of the Royal Microscopical Society, and one of the most active office-bearers of the recently instituted Scottish Microscopical Society. During the early years of his residence in this city he became connected with the Glasgow Society of Field Naturalists, and since the amalgamation of that Society with our own in 1879, he has continued to take an active interest in the progress of our work.

Although to many of us Mr. Schulze was best known as a man of science, those who were privileged with his private acquaintance have borne testimony to his singular modesty and unobtrusiveness, as well as to the geniality of his disposition, which endeared him to a wide circle of friends. He has left a widow and six children to mourn his loss.

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The Chairman read a letter which he had received from Mr. George Murray, F.L.S., Corresponding Member, Secretary of the Committee for the Exploration of the Marine Flora of the West of Scotland, requesting that the aims of the Committee should be made known to the Members of the Society with the view of inviting their co-operation. Mr. Murray stated that the Marine Flora of Western Scotland is less known than that of any other region of the British Coasts, and that although collections have been made by Greville, Walker-Arnott, Landsborough, and others, the record is by no means exhaustive. Outside and north of the Clyde area, the work of the late Captain Carmichael, of Appin, affords practically all the information on record, beyond a few casual specimens. The aim of the Committee is to organise work on the algæ of this

region; and the *Ark* at Millport, which has been placed at their disposal, will be the working head-quarters during the summer months. Mr. Murray indicated that Members of the Society might serve the Committee by collecting and forwarding to him specimens of Seaweeds gathered on the West Coast, and north of the Clyde area, or on any of the Islands, with precise information as to localities, for the purpose of enabling him to name and record the species; and he expressed his willingness to communicate with any who might wish to help the Committee in this work, and to give them all necessary information on the subject.

Mr. Robert Broom, M.B., C.M., B.Sc., exhibited a head of a cyclopean Lamb, on which he made some remarks.

Mr. Robert H. Read, C.E., M.B.O.U., exhibited various Nests and Eggs of British Birds. These included nests of the Capercailzie from Loch Lomond district; a series of nests of the Sedge Warbler, Robin, Chaffinch, Hedge Sparrow, Titlark, Twite, etc., each containing an egg of the Cuckoo; eggs of Guillemot from Flamborough and St. Kilda; eggs of Razorbill from Ailsa Craig; nests of Common Tern and Lesser Tern from Tentsmuir, Fifeshire, etc. Mr. Read also showed a series of models of eggs of the Great Auk.

Mr. D. A. Boyd showed some very beautiful specimens of *Lachnea* (*Sarcoscypha*) *coccinea* (Jacq.), from Portincross, Ayrshire.

The Chairman (Professor Bower) delivered a presidential address, taking for his subject "The Botanic Gardens of Glasgow." After reviewing the history of the gardens, he made some remarks on their present position and prospects of future development. It was with reference to the museum question, of which so much had recently been heard in Glasgow, that he saw a special opportunity of future development in the gardens. If there was one subject more than another in science for which Scotland as a whole, and Clydesdale as much as any other district, had shown a special aptitude, it was botany. Whether in horticulture, or in the study of plants in the open country, Scotchmen had taken a prominent place. The fact that more than 2000 persons had entered the gate of the Botanic Gardens in one day, when the charge for admittance was one penny each, showed how wide-spread was the interest in plants among the population of Glasgow. The City Corporation had already shown their recognition of this aptitude in a most practical way, and they were disposed to take steps for the further improvement of the gardens. He took this opportunity of indicating a further important line of development which would greatly add to the attractions of the gardens for the general public. He would advocate the establishment of a Natural History Museum, separate from the proposed general museum

and art gallery, and that it should be placed on the most natural site for such a museum—viz., in the Botanic Gardens. Thus all the municipal interests in natural history would be centralised at one point instead of being divided as would otherwise be the case. He left others to discuss the question whether a zoological museum should be placed in the gardens at all, but he felt it to be specially his duty as Regius Professor in Glasgow to point out the use of a botanical museum. It might be assumed that such a museum should form part of the general museum and art gallery which it seemed probable would be finally fixed in Kelvingrove, and, indeed, there was at present a series of specimens of vegetable products in the Kelvingrove Museum. But we had before us the precedent of the British Museum. The natural history collections had there been separated from the general museum, and were placed in a separate building at South Kensington with the best possible results both to the public and the sciences. As he did not think any half-hearted scheme would meet with general approval, he would go still further and advocate co-operation with the university. The university possessed a valuable herbarium; it had accumulations of materials for a botanical museum; and there were also certain duplicate botanical books which would form the basis of a working library. He thought it probable that if a joint scheme were entered upon with the university, these books might be deposited in the Botanic Gardens. If proper buildings were erected, and suitable agreements entered into for their management and control, he should certainly be willing to place in them all the museum specimens which belonged to him personally, including his collections made in Ceylon, and he would, under suitable conditions, undertake the arrangement and management of the botanical museum. The kind of building which would meet all requirements of a joint scheme would be of two storeys, and would consist of two wings and a central block. The latter would be a lecture-room, in which, as of old, the university lectures would again be given, and also popular evening lectures for the general public. For his own part, he would take an active share in such popular lectures. The ground floor of the building might be devoted to the museum, with entrance from the gardens. The upper storey would accommodate the herbarium, library, botanical laboratories, etc. He was not at present in a position to state definitely what would be the cost of the undertaking, but it would be a small fraction of the sum which it was intended to devote to the proposed scheme for Kelvingrove. He was convinced that if the Natural History Museum should ever become an accomplished fact, it would prove by no means the least popular public institution in the city. It was commonly thought that the pursuit of botany was a pleasure for the few and the

instructed rather than for the millions of mankind. He admitted that a scientific nomenclature and terminology were essential among those who pursued botany as a definite study, but for the lay public it was not essential, and he would undertake to give a lecture to a popular audience, dealing even with some of the moving questions of the science, which would be expressed in plain English such as anyone could understand.

On the motion of Mr. Joseph Sommerville, a cordial vote of thanks was accorded to Professor Bower for his address.

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24TH FEBRUARY, 1891.

Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., President, in the chair.

Messrs. Adam Knox, 10 Clayton Terrace, Dennistoun, and John Aitken Turnbull, M.A., LL.B., 11 India Street, were elected Ordinary Members.

Mrs. Henry G. Shepherd, Free Church Manse, Cambuslang, was elected an Associate.

The Chairman referred to the loss which the Society had recently sustained in the death of Mr. Robert Mason, F.L.S., and it was unanimously agreed that a memorial notice of the deceased should be recorded in the minutes.

*IN MEMORIAM*—ROBERT MASON, F.L.S.

Robert Mason was a native of Fifeshire, and came to Glasgow many years ago to engage in business in the city. Although the pressure of business duties left him little time for cultivating his favourite study of natural history, yet his love of nature was so strong as to lead him to embrace every opportunity of becoming acquainted with the botany and geology of the district around Glasgow. It is said that for a long period he was accustomed regularly during the summer months to take early morning rambles to places where he could collect some of the rarer plants. Setting off about three o'clock, he was thus able to accomplish as much work before business-hours as his associates could usually overtake in the course of a Saturday afternoon. There were probably few spots within six miles of the city which had not in this way been visited and explored by him. He was on terms of intimacy with the older generation of Glasgow botanists, and especially with the late Mr. William Keddie, Lecturer on Natural Science in the Glasgow Free Church College, and formerly a member of this Society. Although chiefly attached to the study of botany, especially during the earlier years of his life, Mr. Mason was also keenly interested in geology, and took a prominent part in the business of the Geological Society of Glasgow, of which he was a member. He was also a member of the Philosophical

Society of Glasgow. On 29th December, 1868, he was admitted a member of the Natural History Society of Glasgow, and was, in September, 1869, elected a Member of Council. Two years later, on the resignation by Mr. Robert Gray of the office of Secretary, Mr. Mason was appointed his successor, and continued to hold that office for upwards of eleven years.

During Mr. Gray's period of office, the prosperity and influence of the Society had been greatly extended; and the highest tribute that can be paid to the official work of Mr. Mason is the acknowledgment that he succeeded in maintaining the Society in the position to which Mr. Gray's exertions had been mainly instrumental in raising it. The records of the Society were compiled with an accuracy of detail which could only be imparted to them by a naturalist of wide general knowledge and experience, while the scrupulous care bestowed on all departments of his official work showed how faithfully he endeavoured to serve the Society. In September, 1880, Mr. John M. Campbell was appointed Co-Secretary with Mr. Mason. At the close of Session 1881-82 Mr. Mason retired from office, and was afterwards presented by the members with a handsome cabinet, in token of their personal regard for him and high appreciation of his services. In September, 1882, he was elected a Vice-President. He was admitted a Fellow of the Linnean Society in March, 1884. Owing to increasing feebleness, due to his advanced age, Mr. Mason had ceased for several years to take any active part in the affairs of the various local scientific societies with which he was connected. He died on 28th ulto., while in his 81st year, and is survived by an only son.

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Mr. James J. F. X. King, F.E.S., exhibited a fine series of microscopical specimens illustrating the life-history of the Hessian Fly (*Cecidomyia destructor*, Say) from the egg to the adult condition. He stated that until 1886 the insect was unknown in this country, but during that year it appeared in Hertfordshire. In 1887 it had extended over several of the English counties, and the agricultural districts of Aberdeenshire. Since then it has continued to spread over the country, but does not seem to have yet been observed in Ireland. Mr. King described the position in which the eggs of the insect are deposited on the growing stems of cereals, as well as the destructive operations of the larvæ, which so weakens the stem at the point of attack as to cause them to bend downwards. Specimens were also exhibited of four minute species of Hymenoptera which are parasitic on the Hessian Fly. Of these *Platygaster minutus*, L., *Merisus intermedius*, Lindeman, and *Semiotellus nigripes*, Lindeman, have been found in Russia, and *Merisus destructor*, Riley, in America. Mr. King remarked that as the parasites observed in Britain are the same as those found in Russia, the Hessian Fly would seem to have come to us from that country.

Mr. R. S. Wishart, M.A., exhibited specimens of *Polypogon monspeliensis*, Desf., a rare grass which has occurred as a casual weed at Chryston.

Mr. John Renwick exhibited a remarkable condition of the mycelium of a species of *Penicillium*, upon which Professor Bower made some remarks. The fungus had originally formed a mould on the surface of ginger cordial in a bottle, and the hyphæ had continued to develop downwards so as to form a felted horn-like mass, about three inches in circumference, filling nearly the whole centre of the bottle.

The Chairman (Professor Bower) made some remarks on the process of ribbon section-cutting and its use in the study of botany. After describing the structure of the microtome, he explained the method of preparing the tissues to be cut. The great advantage of the ribbon microtome is that it enables almost any number of extremely fine sections to be cut in an uninterrupted series. As these sections are not separated from each other when cut, but produced in the form of a continuous ribbon, they may be mounted side by side. He referred to some obvious advantages of this process, especially from the point of view of botanical morphology, and exhibited the microtome in operation, as well as numerous series of sections which had been produced by its agency.

Professor Thomas King described a simple method of illustrating biological lectures by means of the lantern. A glass slide may be placed over any figure of vegetable tissues or other object desired to be copied, and the outlines traced on the glass by means of a pen and stencil-ink. Slides can be very readily prepared for the lantern in this way, and are in some respects preferable to enlarged diagrams. Numerous illustrative examples were afterwards shown by Professor King, which fully demonstrated the advantages of the method described.

A Paper, entitled "Remarks on Temperature, Vegetation, etc., in the Botanic Gardens, Glasgow, 1890," was submitted by Mr. Robert Bullen, Curator.

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31st March, 1891.

Professor F. O. Bower, D.Sc., F.R.S.E., F.L.S., President, in the Chair.

Mr. James Steel exhibited male and female specimens of the Australian Duck-Mole (*Ornithorhynchus anatinus*, Shaw), and gave an account of the habits of the species. Mr. Robert Broom, M.B., C.M., B.Sc., made some remarks on the affinities of the remarkable group of mammals to which the Duck-Mole belongs.

Mr. Robert H. Read, C.E., M.B.O.U., exhibited Scotch specimens of the Wild Cat, Pine Marten, and Stoat, and described the characteristics and habits of these and other species of British Carnivora.

Mr. L. Watt showed specimens of various Crustacea, including *Limulus polyphemus*, Latr., from New York; *Galathea squamifera*, Montagu, from the Moray Firth; *Thia polita*, Leach, from Banff; and *Polybius Henslowii*, Leach, from the English Channel.

Mr. David Robertson, F.L.S., F.G.S., communicated a Paper entitled "A Second Contribution towards a Catalogue of the Amphipoda and Isopoda of the Firth of Clyde and West of Scotland."*

Mr. Peter Ewing read a Paper entitled "A Fourth Contribution to the Topographical Botany of the West of Scotland."

Mr. George Murray, F.L.S., Corresponding Member, addressed the Society on "The Geographical Distribution of Algæ." After referring to the zonal distribution of seaweeds, and the various influences which aid or retard the migration of species, he stated that although the study of the geographical distribution of algæ is of comparatively recent origin, yet the floras of the Arctic Sea, West Indies, and Australia have been pretty fully investigated. A tabulated statement of the natural orders, genera, and species found within these regions was submitted by Mr. Murray; and he drew attention to the remarkable fact that while the aggregate records for the three regions include 516 genera and 2179 species, of these only 32 genera and 12 species are common to all three regions.†

On the motion of the Chairman a cordial vote of thanks was awarded to Mr. Murray for his interesting address.

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26th April, 1891.

Mr. A. Somerville, B.Sc., F.L.S., Vice-President, in the Chair.

Mr. R. Donaldson, 78 Queen Street; Mr. Robert Dunlop, Whiterigg, Airdrie; and Professor Edward E. Prince, B.A., F.L.S., St. Mungo's College, were elected Ordinary Members.

Mr. John Scott, 3 M'Aslin Street, was elected an Associate.

Professor James Dunlop, M.D., exhibited dissections of the male and female generative organs of the Salmon, with ova before and after impregnation, etc.

Mr. Thomas Boyle showed leaves of the Silver Tree (*Leucadendron argenteum*, R. Br.) and specimens of Heaths and other plants, from Table Mountain, Cape Town.

Professor W. C. M'Intosh, M.D., F.R.S., F.R.S.E., F.L.S., C.M.Z.S., Corresponding Member, addressed the Society on

* *Transactions*, vol. iii., p. 199. † See *Trans. Biol. Soc. Liverpool*, vol. v., p. 164.

"The Development and Life-Histories of Some of the Food-Fishes," and submitted a very extensive series of lantern-views illustrating the successive stages from the unfertilised ovum to the adult fish. In the course of some introductory remarks he directed attention to three principal types of eggs, distinguished by having their protoplasmic contents simple or accompanied by few or many oil-globules. In the third type the numerous oil-globules are sometimes grouped in the form of a circular band surrounding the protoplasm. Taking the Cod as a type of the food-fishes, he illustrated and described the various stages in its life-history; while numerous illustrations of the development of other food-fishes were also submitted for comparison, and attention directed to the chief points of interest which they presented.

On the motion of Professor Prince a cordial vote of thanks was awarded to Professor M'Intosh for his interesting address.

The following papers were submitted:

"List of Shells, etc., observed on the Ardeer and Irvine Beaches, Ayrshire," by Mr. John Smith, Corresponding Member.*

"Some Additions to the Flora of Stirlingshire (Watsonian Vice-County 86)," by Mr. Robert Kidston, F.R.S.E., F.G.S., and Colonel J. S. Stirling of Gargunnock.

* *Transactions*, vol. iii., p. 243.

NATURAL HISTORY SOCIETY OF GLASGOW.

## *ABSTRACT STATEMENT OF ACCOUNTS FOR SESSION 1889-90.*

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| 1889.—Sept. 1. | | |
| To Cash in National Security Savings Bank, | £73 0 1 | |
| Less due to Treasurer, | 5 7 10 | |
| | | £67 12 3 |
| 1890.—Aug. 31. | | |
| To 226 Members' Annual Subscriptions @ 7s. 6d., | | 84 15 0 |
| ,, 2 Life Members' ,, @ £5 5s., | | 10 10 0 |
| ,, 10 Members' Entry-money @ 7s. 6d., | | 3 15 0 |
| ,, 2 Members' Arrears, 7s. 6d., | | 0 15 0 |
| ,, 15 Associates' Subscriptions @ 2s. 6d., | | 1 17 6 |
| ,, Received for Reprints, | | 3 19 6 |
| ,, *Proceedings*, Catalogues, etc., sold, | | 4 13 0 |
| ,, Interest, | | 6 6 11 |
| ,, Subscriptions towards purchase of Ray Society's Publications, | | 13 7 6 |
| | | £197 11 8 |

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|---|---|---|
| 1890.—Aug. 31. | | |
| By Rent and Attendance, | | £6 6 0 |
| ,, Postage, Stationery, etc., | | 11 11 2 |
| ,, Printing *Proceedings*,* Circulars, etc., | | 152 8 6 |
| ,, Library—Additions, | | 5 5 2½ |
| ,, ,, Binding, | | 7 19 6 |
| ,, ,, Insurance,† | | 0 6 0 |
| ,, ,, Postage, Carriage, etc., | | 6 17 0½ |
| ,, Balance in National Security Savings Bank,‡ | £16 0 0 | |
| Less due to Treasurer, | 9 1 9 | |
| | | 6 18 3 |
| | | £197 11 8 |

* This item includes the cost of *Proceedings* for two Sessions.

† This covers the Books, Bookcases, etc., insured to the extent of £300.

‡ The Balance in Bank includes the amount, £13 7s. 6d., received towards purchase of Ray Society's Publications.

GLASGOW, 15*th October*, 1890.—We have examined the Books for the year 1889-90, and have compared the Vouchers, and find them correct, the sum in the National Security Savings Bank being Sixteen Pounds, and the balance due to the Treasurer Nine Pounds One Shilling and Ninepence.

D. MACKENZIE,
THOS. G. BISHOP, } *Auditors.*

## SUMMER SESSION, 1891.

### 12th May, 1891.

Professor Thomas King in the Chair.

The Chairman reported on an Excursion made to Calder Glen, Lochwinnoch, on 9th inst., and stated that 25 plants had been seen in flower. Among the species observed in the glen were *Ranunculus Lenormandi*, F. Schultz, *Cardamine amara*, L., *Prunus Avium*, L., *P. Padus*, L., *Chrysosplenium alternifolium*, L., *Adoxa Moschatellina*, L., *Cnicus heterophyllus*, Willd., *Hymenophyllum unilaterale*, Bory, and *Lycopodium clavatum*, L.

Mr. D. A. Boyd stated that numerous Mosses and Lichens had also been gathered, including *Fontinalis squamosa*, L., *Hyocomium flagellare*, Dicks. (in fruit), *Parmelia physodes* (L.) Ach., *Platysma glaucum* (L.) Nyl., and *Endocarpon fluviatile* (DC.) Nyl.

The remainder of the evening was devoted to the exhibition of a large number of microscopic objects.

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### 26th May, 1891.

Professor Thomas King in the Chair.

Mr. Christopher Sherry reported on a visit made by the Members of the Society to the Botanic Gardens on 19th inst. Among the plants examined in the hothouses and Winter Garden were *Protea cynaroides*, an evergreen shrub, with hard dry leathery leaves whose stomata present several interesting features, and with a head of apetalous flowers resembling a huge composite; *Callistemon salignus*, remarkable for its racemed inflorescence, which resembles a bottle-brush; the showy South European Rock-rose (*Cistus monspeliensis*); *Magnolia fusca*, an extremely free blooming species, the dark-brown flowers of which diffuse a delicious perfume through the Winter Garden; *Chamærops excelsa*, a Chinese Palm with a large staminiferous inflorescence; *Encephalartos villosus* and *Ceratozamia mexicana*, two palm-like dwarf trees belonging to the Cycadaceæ, with undeveloped internodes, and simple trunks whose surface is tessellated with the scars of the fallen leaves, the former species having a large cone-like female inflorescence, and the latter a somewhat similar male flower; a group of carnivorous plants, including Venus' Fly-trap (*Dionœa muscipula*), several species of *Drosera* from the Cape, Pitcher-plants (*Nepenthes*),

and the Side-saddle Plant (*Sarracenia*) with its remarkable peltate stigma; several fine specimens of Tree-Ferns, including *Cyathea medullaris*, a native of New Zealand, with ebony-black stipes; *Alsophila crinita*, a magnificent species recently presented by Professor Bower, with numerous long graceful fronds which give it somewhat the appearance of a palm; an immense and probably unique specimen of the Silver Tree-Fern (*Cyathea dealbata*) with a double trunk; *Asplenium Nidus*, from Australia, commonly known as the "Bird's-nest Fern," from the circular arrangement of its spreading fronds appearing somewhat like a gigantic bird's-nest; *Platycerium alcicorne*, with fronds shaped like the antlers of a stag; *Angiopteris erecta* and *Marrattia cicutifolia*, two representatives of the sub-order Marrattiaceæ, with a succulent irregular caudex upon which the stems are articulated, these being furnished at the base with a pair of large flap-like auricles of a leathery texture. A pan of prothalli, raised from spores of *Marrattia cicutifolia*, was also examined. These differ from the prothallus of the true ferns in being rather fleshy, of a very dark green colour, and having the antheridia developed on the upper as well as the lower surface. Owing to the backward season, there were comparatively few plants in bloom in the herbaceous ground, but the following were observed in flower: *Ranunculus aconitifolius, R. auricomus, R. speciosus, Trollius europæus, T. asiaticus, Caltha palustris, Cardamine macrophylla, Iberis sempervirens, Lychnis diurna, Trifolium subterraneum, Alchemilla alpina, Geum rivale, Potentilla Fragariastrum, Sedum Rhodiola, Saxifraga granulata, S. stellaris, Dondia Epipactis, Chærophyllum aureum, Doronicum Pardalianches, Primula nivalis, Leucojum æstivum*, and *Luzula sylvatica*. Owing to darkness setting in, the Filmy-Ferns, Mosses, and Liverworts in the Mossery could not be seen to advantage; and the inspection of these interesting plants was postponed to a future occasion.

Mr. John Renwick reported on an Excursion made to Loch Humphrey on 23rd inst. The party ascended Glenarbuck, and passed along the Kilpatrick Hills until the loch was reached. The day was very unfavourable, and vegetation on the high ground was found to be in a very backward state. Among the plants observed were *Arabis sagittata*, DC., *Arenaria trinervia*, L., *Cerastium glomeratum*, Thuill., *Prunus Avium*, L., and *P. Padus*, L.

The Chairman (Professor King) exhibited specimens of *Arabis sagittata*, DC., from Glenarbuck.

Mr. John Renwick showed specimens of *Geranium phæum*, L., from Leswalt, Wigtownshire, and *Scilla verna*, Huds., from Portpatrick.

9th June, 1891.

Mr. Robert Turner, Vice-President, in the Chair.

Mr. John Renwick reported on an Excursion made on the evening of 2nd inst. to the line of the old canal between Glasgow and Paisley. Most of the canal has now been filled up and converted into a railway; but in some places the original banks remain intact, with occasional pools and marshes where many of the canal-plants still continue to grow. Nothing of any rarity was observed.

Mr. Renwick also reported on an Excursion made on 6th inst. to Gargunnock, under the leadership of Colonel J. S. Stirling. Mr. Richard M'Kay stated that the plants seen included *Pyrola minor*, Sw., *Listera ovata*, R.Br., *Arum maculatum*, L., *Phegopteris Dryopteris*, Fée, *P. polypodioides*, Fée, and *Splachnum sphæricum*, L.fil. The following Desmids were also obtained: *Staurastrum punctulatum*, Breb., *S. spongiosum*, Breb., *S. hirsutum*, Breb., *S. dejectum*, Breb., *Cosmarium margaritiferum* (Turp.) Archer, *C. botrytis*, Menegh., *Pediastrum* (various species), *Closterium lunula* (Müll.) Ehr., *Euastrum didelta*, Ralfs, *E. ansatum*, Ralfs, *Arthrodesmus convergens*, Ehrh., *Penium digitus*, Ehrh., *Sphærozosma excavatum*, Ralfs, and *Desmidium Swartzii*, (Ag.) Ralfs. Specimens of the above species of Desmids were exhibited under the microscope.

Professor Thomas King exhibited specimens of *Prunus Mahaleb*, DC., a native of Australia, and several other plants.

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23rd June, 1891.

Professor Thomas King in the Chair.

Mr. John Renwick reported on an Excursion made on 13th inst. to Murroch and Auchenreoch Glens. On Dumbarton Common were found *Ranunculus peltatus*, Schrank, *R. hederaceus*, L., *Barbarea vulgaris*, R.Br., *Salix purpurea*, L., *S. rubra*, Huds., *S. viminalis*, L., and *Equisetum maximum*, Lam. In the glens were seen *Ranunculus bulbosus*, L., *Hieracium vulgatum*, Fr., var. *maculatum*, Sm.; *Salix cinerea*, L., var. *aquatica*, Sm.; and *Juniperus communis*, L. *Listera cordata*, R.Br., was found on the moor above Dumbarton.

Mr. Renwick also reported on an Excursion made to Shielhill Glen, on 20th inst., and stated that *Vicia sylvatica*, L., had been obtained in that locality.

Professor Thomas King showed flowering plants of *Lysimachia thyrsiflora*, L., and *Lemna minor*, L., from Possil Marsh, where both species are common but can rarely be found in bloom.

Mr. Christopher Sherry exhibited specimens of *Hydnangium carneum*, Wallr., a rare fungus from the Botanic Gardens. It is one of the subterranean Gastromycetes, about the size of

a small cherry, and is found in association with plants of *Eucalyptus*. Mr. Sherry stated that the species had been recorded for the Edinburgh district. Some of the spores, which are globose and echinulate, were exhibited under the microscope.

Numerous other microscopic specimens were afterwards exhibited.

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4TH AUGUST, 1891.

Mr. John Renwick in the Chair.

The Chairman reported on Excursions made on 4th July to Barskimming, near Mauchline, and on 1st August to Ladyland, near Kilbirnie. Among the plants obtained in the former locality were *Claytonia alsinoides*, Sims, *Vicia sylvatica*, L., *Habenaria bifolia*, R. Br., and *H. chlorantha*, Bab.; and in the latter locality *Astrantia major*, L., and *Mimulus luteus*, L.

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18TH AUGUST, 1891.

Mr. William Stewart, Vice-President, in the Chair.

Mr. John Renwick reported on an Excursion made to Cambuslang on the evening of 11th inst. A Sycamore (*Acer Pseudoplatanus*) at Westburn was measured and found to be 16 ft. 5 in. in girth at 4 ft. 3 in. from the ground. On 10th March, 1888, this tree measured 16 ft. 2 in. at the narrowest part, thus showing an increase in girth of three inches as a result of four seasons' growth. It is handsome and well-grown, but a few of the branches are beginning to show signs of decay. A neighbouring Birch (*Betula alba*), which measured 5 ft. 2 in. in girth when visited in 1888, is now quite dead although still standing.

Mr. Renwick also reported on an Excursion made to Mauldslie on 15th inst. The district is exceedingly picturesque, and the estate contains many trees of remarkable size and beauty. Among the plants found were *Hypericum hirsutum*, L.; *Neottia Nidus-avis*, Rich., in considerable abundance; and *Epipactis latifolia*, Sw., recorded in the *New Statistical Account of Scotland* as growing at Mauldslie. A specimen of *Alnus glutinosa*, L., var. *incisa*, was noticed at the bridge over the River Clyde.

Mr. Richard M'Kay submitted a note of the measurements of the largest trees seen at Mauldslie, which were as follows:

I. White Poplar (*Populus alba*), on the lawn between the Castle and the River Clyde, 18 ft. round stem at 3 ft. from ground; the tree branches just above the part measured; the first branch measures 8 ft. near its base; and the stem above this branch, 17 ft. Another White Poplar, near the hill on which the burial-ground stands, measures 15 ft. 4 in. at 3½ ft. from ground. Both these trees are tall, wide-spreading, and very fine.

II. Scotch Fir (*Pinus sylvestris*).—The following Scotch Firs are all in the wood on the hilly ground : (1) 10 ft. 3 in. at a height of 5 ft. 9 in. ; (2) a very tall straight tree, measuring 10 ft. 0½ in. at 5 ft. 6 in. ; (3) 9 ft. 4½ in. at 6 ft. 3 in. ; (4) 8 ft. 7 in. at 5 ft. 9 in. ; (5) 8 ft. 7 in. at 6 ft.*

III. Wych Elm (*Ulmus montana*).—(1) On lawn between the Castle and River Clyde, 14 ft. 1 in. at 5 ft. 2 in. ; (2) near the Clyde, 13 ft. 1½ in. at 4 ft. 3 in. ; (3) near No. 1, 9 ft. 5 in. at 5 ft. 3 in. The Scotch specimens larger than the above are (1) Roxburgh Castle, near Kelso, 16 ft. 11 in. at 3 ft. 9 in. ; (2) Aikenhead, near Glasgow, 15 ft. ; (3) Strathleven, Dumbarton, 14 ft. 8 in. at 2 ft. 6 in. ; (4) Erskine, 14 ft. 5 in. A tree at Fountains Abbey, Yorkshire, measured 20 ft. 10 in. at 6 ft. 3 in.

IV. Gean (*Prunus Avium*) on lawn, 12 ft. 7½ in. at 2 ft. 9 in. The largest previous measurement was 11 ft. 3½ in., on Loch Lomond side.

V. Oak (*Quercus Robur pedunculata*) near garden, 11 ft. 1 in. at 4 ft. ; (*Q. Robur sessiliflora*) near Clyde, 8 ft. 3½ in. at 5 ft. 3 in.

VI. Ash (*Fraxinus Excelsior*).—(1) Near Clyde, 12 ft. 3½ in. at 4 ft. 6 in. ; (2) another tree, 10 ft. 4½ in. at 4 ft. 6 in.

VII. Silver Fir (*Abies Picea*) in wood, 9 ft. 4 in. at 5 ft. 6 in.

VIII. Larch (*Larix europœa*) in wood, 11 ft. 11½ in. at 3 ft. 9 in. and 9 ft. 8 in. at 6 ft. 9 in.

IX. Wellingtonia (*Sequoia gigantea*) near south-west angle of Castle, 10 ft. 2½ in. at 1 ft. A tree of this species at Ardgowan measured 11 ft. 8 in.

Mr. Charles Ritchie exhibited specimens of *Epimedium alpinum*, L., and other plants, from the Falls of Moness, Aberfeldy.

Professor King also exhibited specimens of *Anthemis arvensis*, L., gathered at Langbank by Mr. H. Simpson ; *Linnœa borealis*, Gronov., from Grantown-on-Spey ; and, for comparison, specimens of *L. borealis* gathered in Norway by Mr. A. L. Black.

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## 1st September, 1891.

Mr. William Stewart, Vice-President, in the Chair.

Professor Thomas King reported on an Excursion made on 29th August to Duchal, near Kilmalcolm. Among the plants observed were *Mahonia aquifolia*, Nut. (cultivated in the grounds at Duchal), found to be almost covered with its blue-black berries; *Prunus Padus*, L., also in fine fruit ; and *Rubus suberectus*,

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* The only Scotch specimen I have measured larger than the above is one at Rossdhu, Loch Lomond, it being 10 ft. 9½ in. at 5 ft. One at Fountains Abbey, Yorkshire, measures 10 ft. 11 in. at 5 ft. 2 in.—*R. M'K.*

Anders. Fungi were scarce, the most noteworthy species found being *Agaricus* (*Entoloma*) *nidorosus*, Fr. A large Spanish Chestnut tree (*Castanea sativa*, Mill.) was measured by Mr. Richard M'Kay and found to be 14 ft. 6½ in. in girth, showing an increase of 2½ inches since it was formerly measured on 8th September, 1888.

Mr. F. N. Sloane, C.A., exhibited a nest of a Humming-Bird, from San Domingo, composed of native cotton, with pieces of lichen attached externally which had been taken by the bird from the trunk of an orange-tree in which the nest was placed. He also showed a nest of a Trap-door Spider from New Guinea; and specimens of native cotton, and various kinds of timber, from San Domingo.

## WINTER SESSION, 1891-92.

### 29th September, 1891.

Mr. William Stewart, Vice-President, in the Chair.

Mr. George M'Crie, 61 Sardinia Place, Hillhead, was elected an Ordinary Member.

Mr. James Steel, jun., 14 Shamrock Street, was elected an Associate.

Professor Thomas King reported on an Excursion made to Milliken on 12th inst., and submitted a list of 37 fungi observed in the woods. The rarer species found included *Helvella elastica*, Bull., and *Cantharellus infundibuliformis*, Scop.

Mr. R. Turner, Vice-President, reported that the closing Excursion of the Summer Session had been made to Hamilton on the afternoon of 26th inst., when in spite of rather unfavourable weather there was a good attendance of members and their friends. By the kind permission of Lord Ruthven, access was obtained to the policies and gardens at Barncluith.

The Chairman (Mr. Stewart) gave an account of the Excursions, Conference, and Exhibition of Mosses, Fungi, Algæ, etc., held in connection with the recent visit of the Cryptogamic Society of Scotland to Paisley.

Mr. Henry M'Culloch exhibited several Birds, including a small collection of Terns from Mauritius, and a Reeve and albino Grouse, both shot in the Clydesdale district.

Mr. Duncan Mackenzie exhibited a nest of the Hornero or Oven-bird (*Furnaria*) of South America. The nest, which is built of clay and herbage, is about 8 inches in diameter, with walls about an inch thick. It is dome-shaped, with an opening in the side; and the central cavity is divided by a partition into two chambers, in the inner of which the eggs are deposited. It is usually placed in a very exposed place, such as a tree-trunk or paling-top, the specimen under notice having been built upon a telegraph-pole.

Mr. Thomas Scott, F.L.S., Corresponding Member, exhibited a remarkably depressed variety of the common Sea-urchin, *Echinus esculentus*, Pennant (*E. sphæra*, Müller), from the Firth of Forth. He stated that the specimen under notice was found, when compared with the usual dimensions of the species, to be ⅝ inch lower than the normal height in proportion to the diameter. Another specimen of *E. esculentus* was submitted by Mr. Scott which was much higher than usual, and somewhat pentangular in shape through flattening of the interambulacral areas.

The Chairman (Mr. Stewart) exhibited specimens of Fungi from various parts of the Clyde area, including *Agaricus (Amanita) mappa*, Fr., *A.* (*Clitocybe*) *splendens*, Pers., *A.* (*Collybia*) *maculatus*, A. & S., *A.* (*Clitopilus*) *prunulus*, Scop., *Cortinarius* (*Phlegmacium*) *claricolor*, Fr., *Lactarius pargamenus*, Fr., *Lentinus cochleatus*, Pers., *Polyporus giganteus*, Pers., *P. picipes*, Fr., *Helvella crispa*, Fr., and *Cordyceps capitata* (Holmsk.) Link.

Professor Thomas King made some remarks on the work of the Committee for the Exploration of the Marine Algæ of the West of Scotland, and stated that during the month of August last Mr. E. A. L. Batters, B.A., LL.B., F.L.S., had succeeded in adding 40 species to the list of these plants found in the Clyde area. Professor King exhibited specimens of the following species collected by himself at Millport last summer, all of which had been submitted to Mr. Batters for verification, viz.: *Cladophora utriculosa*, Kütz., var. *lætevirens*, Hauck; *Asperococcus bullosus*, Lamx.; *Gelidium corneum*, Lamx.; *Cystoclonium purpurascens*, Kütz.; *Lomentaria articulata*, Lyngb.; *Delesseria sinuosa*, Lamx.; *Polysiphonia urceolata*, Grev.; *P. nigrescens*, Grev.; *P. elongata*, Grev.; *Ptilota plumosa*, C. Ag.; *Ceramium acanthonotum*, Carm.; and *Dilsea edulis*, Stackh.

Mr. D. A. Boyd read a Paper on "Local Biological Investigation in connection with Committees of the British Association." After describing the relations which exist between the British Association and its Corresponding Societies, he referred to the mutual advantages arising from these relations, and indicated some of the ways by which provincial societies might render important aid to biological investigations conducted by Committees appointed by the British Association.

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## THE FORTIETH ANNUAL GENERAL MEETING.

27TH OCTOBER, 1891.

Mr. William Stewart, Vice-President, in the Chair.

The Chairman referred to the loss which the Society had sustained in the death of the Rev. James Fordyce, Bishopbriggs, and testified to the high respect in which the deceased gentleman was held by his numerous friends in the Society.

The Secretary (Mr. D. A. Boyd) read the

### REPORT OF THE COUNCIL.

*Membership.*—During the past year 1 Honorary and 11 Ordinary Members have been elected; while the names of 1 Corresponding and 26 Ordinary Members have been removed from the Roll.

Of these 4 have been removed through death, 15 through resignation, and 8 on account of non-payment of arrears of subscription.

The present membership is as follows:

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| Honorary, | | 16 |
| Corresponding, | | 42 |
| Ordinary— | | |
| Life Members, | 30 | |
| Annual, | 241 | |
| Suspended, | 13 | |
| | | 284 |
| Total Membership, | | 342 |

*Obituary.*—The Obituary Record contains the names of Messrs. John Shaw, Ph.D., F.L.S., elected in 1886; J. D. Dougall, elected in 1879; Adolf Paul Schulze, F.R.S.E., F.R.M.S., admitted in 1879; and Robert Mason, F.L.S., elected in 1863.—Dr. Shaw was the senior Corresponding Member on the Roll, having been elected an Ordinary Member in 1866, and afterwards a Corresponding Member on his removal from Glasgow to South Africa. During his residence in this country he took an active interest in the Society, and frequently contributed papers and exhibited specimens at the meetings. His favourite pursuit was Bryology, in the investigation of which he had attained considerable eminence. Many records of Scottish mosses are due to his research; and of these the two species *Campylopus Shawii*, Wils., and *Orthotrichum Shawii*, Wils., have been named after their discoverer.—Mr. J. D. Dougall was born in Glasgow in 1818, and for many years carried on business as a gun-maker in the city. He was the author of various books, the best-known of which are his *Scottish Field Sports; Shooting Simplified;* and *Shooting: its Appliances, Practice, and Purpose*, the last-named of which has been translated into French, German, and Italian. He was also the author of the article on "Shooting" in the most recent edition of the *Encyclopædia Britannica.* In 1865 he succeeded in introducing nitro-compound powders in a practical form for purposes of shooting.—Mr. A. P. Schulze was well known as one of the most eminent of Scottish microscopists.—Mr. Mason acted as Secretary of the Society from 1871 to 1882. With an extensive knowledge of natural history, especially in the departments of botany and geology, he possessed methodical business habits which enabled him to discharge the duties of his office with an eminent degree of success.

*Associates.*—During the past year 5 Associates have been elected, while 2 have resigned. The number at present on the Roll is 22.

*Meetings and Excursions.*—Eight meetings were held during the Winter Session, at which numerous zoological and botanical specimens were exhibited and various important communications

read. Reports of the meetings were regularly supplied to the local newspapers.

Eight meetings were held during the Summer Session, and an Exhibition of Microscopic Objects took place at the meetings on 12th May, 23rd June, 18th August, and 15th September.

Fourteen Excursions were made as follows: 9th May, Calder Glen; 19th May, Botanic Gardens; 23rd May, Loch Humphrey; 2nd June, Paisley Canal; 6th June, Gargunnock: 13th June, Murroch and Auchenreoch Glens; 20th June, Shielhill Glen; 4th July, Barskimming; 1st August, Ladyland; 11th August, Cambuslang; 15th August, Mauldslie; 29th August, Kilmalcolm; 12th September, Milliken; 26th September, Barncluith.

It is the desire of the Council that the Meetings and Excursions should be rendered as generally useful and acceptable to the Society as possible, and they will be glad to consider any suggestions which may be made with the view of attaining this end. These may be addressed to either of the Secretaries, or to any member of the Summer Committee.

*Library.*—At the close of last Session a complete set of the publications of the Ray Society was offered to the Council at the price of £38; and through the liberality of various Members and Associates, the amount required for the purchase has been fully subscribed, and the volumes added to the Library. The cordial thanks of the Society are due to the subscribers to the purchase-fund, whose generous gift will, it is hoped, have the effect of directing local attention to numerous departments of Invertebrate Zoology which have hitherto been neglected or imperfectly investigated by the Society, owing to want of access to descriptive monographs of the British species.

The Librarian (Mr. James J. F. X. King, F.E.S.) reported that the number of publications received from other Societies, Institutions, etc., was about the same as last year. During the Session, through the voluntary subscriptions of the Members and Associates, 64 volumes of the publications of the Ray Society had been added, thus completing the valuable set of monographs, among which are many standard authorities on the subjects upon which they treat. The book-case accommodation was now inadequate for the requirements of the Library.

The Treasurer (Mr. John Renwick) submitted an audited Statement of Accounts, for the year ending 31st August, showing a balance of £34 1s. 9½d. at the credit of the Society, exclusive of £100 invested on debenture, and the value of books and other property insured for £300.

The Reports read were all unanimously approved and adopted.

The Society then proceeded to the election of Office-Bearers, when Mr. Robert S. Wishart, M.A., was elected a Vice-President, and Professor Edward E. Prince, B.A., F.L.S., Mr. Robert Edgar,

M.A., Mr. Robert Grierson, Mr. Duncan M'Laren, Mr. Joseph Sommerville, and Mr. Duncan Mackenzie, Members of Council—the Council being as follows: President, Professor F. O. Bower, D.Sc., F.R.S., F.R.S.E., F.L.S.; Vice-Presidents, Robert Turner, William Stewart, and R. S. Wishart, M.A.; Secretaries, D. A. Boyd and James Steel; Treasurer, John Renwick; Librarian, James J. F. X. King, F.E.S.; Members of Council, Professor Thomas King, James Barrie Low, M.A., Duncan Mackenzie, David Pearson, Peter Ewing, Johnston Shearer, Christopher Sherry, Joseph Sommerville, Robert Edgar, M.A., Robert Grierson, Duncan M'Laren, and Professor Edward E. Prince, B.A., F.L.S.

Messrs. W. A. Dobie and James Mitchell were appointed Auditors for the ensuing year.

The following were elected Ordinary Members: Mr. James Clark, Chapel House, Paisley; Mr. Hector Dove, B.Sc., 19 St. Andrew's Road, Pollokshields; Mr. Samuel C. B. Edgar, 15 Lumsden Street, Overnewton; Mr. John Polson, Westmount, Paisley; and Mr. James Swanson, M.A., M.B., C.M., 20 Woodlands Road.

Professor Thomas King exhibited specimens of *Elymus arenarius*, L., from Lossiemouth, *Lactarius obnubilus*, Lasch., from Dollar, and various other Fungi from the latter district.

Mr. D. A. Boyd showed numerous specimens of Lichens from West Kilbride and Largs, including *Collema nigrescens* (Huds.) Ach., *Platysma sæpincola* (Ehrh.) Nyl., *Stictina fuliginosa* (Dicks.) Nyl., *Parmelia scortea*, Ach., *P. omphalodes* (L.) Nyl., *P. caperata* (L.) Ach., *P. Borreri*, Turn., *Lecanora coccinea*, Dicks., *L. tartarea* (L.) Ach., etc.

Mr. Boyd also showed specimens of the æcidiospores of *Uromyces parnassiæ* (DC.), found on leaves of *Parnassia palustris* at Killin; uredospores of *Puccinia oxyriæ*, Fckl., found on leaves of *Oxyria digyna* on Craig Chailliach; and *Æcidium prunellæ*, Winter, found on leaves of *Prunella vulgaris* at Killin. He stated that these fungi had all been gathered during the third week of July.

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24TH NOVEMBER, 1891.

Professor Thomas King in the Chair.

Professor Edward E. Prince, B.A., F.L.S., exhibited specimens of *Amphioxus lanceolatus*, Yarrell, from the Mediterranean, and described the remarkable morphological features presented by this fish, which he regarded as illustrative of a degraded rather than primitive type.

Mr. David Robertson exhibited specimens of *Asteronyx Loveni*, Mont., dredged in from 50 to 60 fathoms water in Lower Loch Torridon.

Mr. D. A. Boyd showed specimens of the following plants from the localities indicated, viz.:

*Arenaria* (*Alsine*) *verna*, L.—Meall Dhuin Croisg, Killin.—*Rev. E. F. Linton, M.A.*

*Sphærophoron compressum*, Ach.—Ben More, Perthshire (with apothecia).—*Mr. E. M. Holmes.*

*S. coralloides* (Pers.) Ach.—Kaim Hill, West Kilbride (with apothecia).

*Stictina Thouarsii* (Del.) Nyl.—Neighbourhood of Oban.—*Mr. Holmes.*

*S. crocata* (L.) Nyl.—Neighbourhood of Oban.—*Mr. Holmes.*

*Physcia leucomela* (L.) Mich.—Ballard Down Swanage.—*Mr. Holmes.*

*Lecanora* (*Placopsis*) *gelida* (L.) Ach.—Portincross, Ayrshire (with apothecia).

*Puccinia dioicæ*, Magnus.—Æcidiospores (*Æcidium cirsii*, DC.) on leaves of *Cnicus palustris*; Killin.

*P. obscura*, Schröt.—Æcidiospores (*Æcidium compositarum*, Mart., var. *bellidis*, DC.) on leaves of *Bellis perennis*; Seamill, Ayrshire.

Mr. David Robertson, F.L.S., F.G.S., exhibited specimens of *Ascophyllum Mackaii* (Turn.) Holm. et Batters, forma *Robertsoni*, Batters, a seaweed recently discovered by him at Loch Ranza, Arran.*

Professor Edward E. Prince, B.A., F.L.S., read a paper on *Maurolicus borealis*, Nilss., one of the British phosphorescent Fishes, which was illustrated with a series of specimens and diagrams. He stated that the species, which measures from two to three inches in length, appears to be a pelagic form, occurring far out at sea, and probably at considerable depths, although specimens have sometimes been taken at the shore, where they may probably have been driven during storms. A great number were thus obtained at Redcar in 1852; several hundreds were picked up on the sands at Aberdeen, a few years ago, by Mr. George Sim; and Professor Prince was so fortunate as to obtain a living specimen (afterwards accidentally destroyed) in a tidal pool at St. Andrews. The photodisks, or phosphorescent organs, are arranged in two rows along either side of the fish, and those of the upper row differ somewhat in appearance from the others. They are all sunk in the integument, and do not protrude through its surface. They present the appearance of eye-like disks, with a yellowish centre which is probably transparent in the living state. Round what may be termed the yellowish pupil is a thin silvery striated rim. The cornea, or outer lens, seems to consist of two coats, the inner of which takes the usual carmine stain. Beneath the cornea is the photodisk proper, which also consists

* *Transactions*, vol. iii., p 270.

of an outer and inner portion, the former being composed of a thick fibrous layer forming the iris, and the latter of a network of glandular matter without nuclear or clavate cells. Each series of photodisks is connected with a roe-like organ running down either side of the body, outside the muscles. They appear to be portions of the roe-like mass pushed out to the surface. In the anterior region these lateral organs are widely separated by the abdominal cavity, but they meet at the anal extremity. They are intimately related to the mucous canal, which passes along a tube formed by the fibrous coat enclosing the whole system of photodisks. As the eyes of the fish are remarkably well developed, there seems no reason for the assertion which has been made that the photodisks are organs of sight. They appear rather to be highly sensitive structures, capable of being stimulated by impressions from without, and of emitting light.

Mr. R. J. Harvey Gibson, M.A., F.R.S.E., F.L.S., University College, Liverpool, submitted a Preliminary List of the Marine Algæ of the Oban District.*

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29TH DECEMBER, 1891.

Mr. William Stewart, Vice-President, in the Chair.

Mr. James Steel referred to the loss which the Society had sustained through the death of Mr. James Dairon, F.G.S., one of the Ordinary Members; and it was unanimously agreed that a memorial notice of the deceased should be recorded in the minutes.

*IN MEMORIAM*—JAMES DAIRON, F.G.S.

Mr. Dairon was born in Edinburgh about the year 1810. After having served his apprenticeship as a plasterer in that city, he travelled over the greater part of England, and worked in many of the larger towns. He finally resolved to settle in Glasgow, where, for many years, he has successfully carried on business. Although unremitting in his attention to business, Mr. Dairon had also a keen taste for scientific pursuits, which he cultivated with much success. He was specially interested in geology, and had formed a very extensive collection of specimens. His favourite branch of study was the Silurian Graptolites, and he had long been recognised as a leading authority on that subject. Several important papers were from time to time communicated by him to the Geological Society of Glasgow and published in its Transactions. With his scientific tastes Mr. Dairon combined considerable artistic skill. He designed and constructed an enlarged set of models of Graptolites, which have been universally admired for their artistic excellence, as well as for the general accuracy of their details.

* *Transactions*, vol. iii., p. 224.

In 1865 he was elected an Ordinary Member of the Natural History Society of Glasgow; and in November, 1883, he was appointed a Member of Council. From October, 1885, till April, 1888, he held the office of Vice-President, and frequently occupied the chair at Meetings of the Society. During these five years Mr. Dairon took an active interest in the affairs of the Society, and rendered many important services to the Council. He was also a Fellow of the Geological Society of London, and a Member of the Geological Society of Glasgow.

Of late years he had been accustomed to spend some months annually at his country residence at Moffat; and, in spite of advancing age, he was in the habit of making long excursions among the Dumfriesshire hills in the pursuit of his favourite study. His temperament was essentially active, and this, combined with a habit of steady perseverance, enabled him to overcome apparent obstacles and attain well-merited success in almost everything he undertook. His manner was distinguished by plain simple honesty and kindness, which inspired the confidence and respect of all who were acquainted with him. He is survived by a family of two sons and two daughters.

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Mr. Steel also referred to the death of Mr. Archibald Robertson, a former Member and Office-bearer of the Society.

Mr. Henry M'Culloch showed a Female Golden Eagle (*Aquila chrysaetus*, L.), recently shot in the Lochaber district, and kindly lent by Mr. David Rennie, Commercial Bank, Gordon Street, for exhibition to the Society.

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of *Isocardia cor*, L., trawled off the coast of Aberdeenshire.

Mr. D. A. Boyd showed specimens of *Mollisia* (*Pseudopeziza*) *cerastiorum* (Wallr.) Phil., a Discomycete recently found by him near Seamill, Ayrshire, and apparently new to the West of Scotland. It grows on the leaves of *Cerastium triviale*, Link, and has been found by Mr. C. B. Plowright at King's Lynn, and by Professor Trail at Udny, Aberdeenshire.

A paper was read by Mr. Boyd on "The Vertical Distribution of Plants in relation to Local Records." After referring to some of the advantages of a systematic registration of localities for plants, he stated that the two systems at present adopted for that purpose were defective, in so far as they did not make any adequate provision for ascertaining the levels at which plants appear or disappear in different parts of the country, or for observing the natural conditions (soil, exposure, geological formation, etc.) which influence the growth of plants in different localities. Directions were given by which a vertical survey of Scottish plants might be carried out on the basis of parallel zones of altitude, ranging from sea-level to the tops of the highest mountains.

26TH JANUARY, 1892.

Mr. R. S. Wishart, M.A., Vice-President, in the Chair.

Mr. Henry M'Culloch exhibited a specimen of the Bohemian Waxwing, *Ampelis garrulus*, L., recently shot at Doonfoot, near Ayr.

Mr. P. Ewing exhibited specimens of a peculiar form of *Cochlearia officinalis*, L., gathered by him on Culter Fell, Lanarkshire, in July last, and differing in some respects from the maritime and alpine varieties; also *Carlina vulgaris*, L., and *Saxifraga stellaris*, L., from the same locality; as well as the following plants, gathered by him at Clova last July, viz.: *Lychnis alpina*, L., *Astragalus alpinus*, L., *Cornus suecica*, L., *Linnæa borealis*, Gronov., *Betula nana*, L., *Salix Myrsinites*, L., vars. *procumbens* (Forbes) and *arbutifolia*, Syme; *Carex capillaris*, L., type and var. *alpestris*, Anderss.

Mr. D. A. Boyd exhibited specimens of *Hymenoscypha* (*Cyathoidea*) *cyathoidea* (Bull.) Phil., *Calloria fusarioides* (Berk.) Fckl., and *Heterosphæria patella* (Tode) Grev., all from the neighbourhood of West Kilbride.

Mr. C. O. Sonntag made some remarks on the structure of seeds of Indian Corn, *Zea Mays*, Wahl., which he illustrated by means of drawings, and longitudinal sections through the seeds and embryos. He also drew attention to the internal structure of seeds of Mistletoe, *Viscum album*, L., which are remarkable for containing two and sometimes three distinct embryos. Microscopical sections of these seeds were also exhibited.

Rev. A. S. Wilson, M.A., B.Sc., addressed the Society on "The Movements of Plants." In the course of his remarks, which were illustrated by means of a large series of diagrams, he described the various kinds of movements produced by plants, and gave an interesting account of the experiments which led Darwin to state his theory that motion is a universal characteristic of plant life, and that different movements are modifications of the one fundamental motion of circumnutation. An interesting discussion followed, and on the motion of the Chairman a cordial vote of thanks was awarded to Mr. Wilson for his address.

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23RD FEBRUARY, 1892.

Mr. R. S. Wishart, Vice-President, in the Chair.

The Secretary (Mr. Boyd) reported that the Council had appointed Mr. James Mitchell to be Librarian, in room of Mr. James J. F. X. King, F.E.S., resigned, and that Mr. Mitchell had accepted the office.

The Secretary made some remarks on the work of the Committee appointed by the British Association to investigate the

causes which have led to the partial or total extinction of certain native plants in various parts of the country. He moved, and it was unanimously resolved, that the Society should endeavour to aid the Committee by submitting a Report for the West of Scotland, and that Professor Thomas King should receive materials for its preparation.

Mr. David Robertson, F.L.S., F.G.S., exhibited an unusually large specimen of *Zeugopterus punctatus*, Bl., from Cumbrae.*

Mr. A. Somerville, B.Sc., F.L.S., exhibited specimens of Sedges gathered by him last July and August in the Upper Strathspey district. These included *Carex rigida*, Good., from Scor-an, one of the Cairngorm range of mountains; *C. aquatilis*, Wahl., from between Kingussie and Aviemore; *C. filiformis*, L., from Loch Alvie; and numerous other species.

Professor Thomas King showed a collection of Ferns from New Zealand.

Mr. Christopher Sherry exhibited living specimens, from the Glasgow Botanic Gardens, of *Botrychium ternatum*, Sw., and *B. virginicum*, Sw., both natives of the United States.

Mr. Sonntag showed a fine series of Desmids collected between Gourock and Wemyss Bay, on Helensburgh moor, and in various other parts of the Clydesdale district. Among the rarer species exhibited were *Micrasterias rotata*, Grev., *M. denticulata*, Breb., *M. truncata*, Corda, *M. papillifera*, Breb., *M. crux-melitensis*, Ehr., *M. americana*, Ehr. (*M. morsa*, Ralfs), *M. Jenneri*, Ralfs, *Euastrum verrucosum*, Ehr., *E. oblongum*, Grev., *E. affine*, Ralfs, *E. insigne*, Hass., *E. elegans*, Breb., *E. binale*, Ralfs, *E. cuneatum*, Jen., *Cosmarium ovale*, Ralfs, *C. Ralfsii*, Breb., *C. ornatum*, Ralfs, *Xanthidium armatum*, Breb., *X. cristatum*, Breb., *Staurastrum tumidum*, Breb., *S. furcatum*, Ehr., var. *armigerum* (*S. spinosum*, Ralfs), *S. brachiatum*, Ralfs, *S. sexcostatum*, Breb., *Tetmemorus lævis*, Ralfs, *Penium interruptum*, Breb., *Docidium clavatum*, Kutz., *Closterium turgidum*, Ehr., *C. attenuatum*, Ehr., *C. rostratum*, Ehr., and *C. Ralfsii*, Breb.

Mr. Richard M'Kay exhibited some microscopic sections illustrating the structure of roots of *Tilia*, stems of *Pteris aquilina*, etc.

Mr. John Smith, Corresponding Member, submitted a paper on the distribution of *Equisetum maximum*, Lam., and *E. hyemale*, L., throughout Ayrshire.†

Mr. D. A. Boyd read a paper on *Hymenoscypha* (*Sclerotinia*) *Curreyana* (Berk.) Phil., a fungus which grows from a sclerotium formed in dead stems of *Juncus communis*; and he stated that while the sclerotium (which was formerly described

* *Transactions*, vol. iii., p. 267. † *Ibid*, p. 249.

as a separate plant under the name of *Sclerotium roseum*, Kneiff) appeared to be fairly common in various parts of Scotland, the fungus was not often found in a perfectly developed condition. Several specimens, one of which was submitted for exhibition, had recently been gathered by him at Chapelton, near Seamill, Ayrshire.

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29TH MARCH, 1892.

Mr. William Stewart, Vice-President, in the Chair.

Mr. Henry M'Culloch exhibited specimens of the Iceland Gull, *Larus leucopterus*, Fab., and Glaucous Gull, *L. glaucus*, L., both recently shot in the neighbourhood of Campbeltown.

Professor Edward E. Prince, B.A., F.L.S., exhibited a specimen of the Natterjack Toad, *Bufo calamita*, Laur., from County Kerry, Ireland. He stated that the species is locally distributed throughout England, and has been found in one locality in County Kerry. It is readily distinguished by a prominent golden-yellow line which runs down its back, as well as by its variegated colouring. It is more active than the Common Toad (*B. vulgaris*, Laur.), and runs very rapidly, but does not leap. Its voice is very loud and peculiar, and quite unlike the croaking of allied species. The specimen under notice was kept many months, and took food readily.

Professor Prince also exhibited specimens of the Grey Skate (*Raia batis*, Linn.) at an early stage of growth. Among these was a very young worm-like example of special interest on account of the rarity of specimens of the fish at so extremely young a stage. The flat form of the Skate was not yet indicated. The breast-fins and ventral-fins occurred as long folds at either side of the body. The yolk had been removed, and the vitelline stalk showed the connection which had existed between the fish and the food-yolk. The eye was coloured with black pigment; the head was curved round, and the optic lobes bulged out in front, as in most vertebrate embryos. In addition to the gill-slits, external gills were present as two groups of thread-like filaments, which probably served the fish more for absorbing nutriment than for respiration. The long tail was notable for the presence of four longitudinal fins, viz.: the dorsal, ventral, and two lateral fins.

The other and older specimens had most of the features of the adult; but the yolk was still large, and the external bunches of gill-filaments stood out on the under side of the head. The four finfolds still existed towards the tip of the tail.

Professor Prince also showed a very young specimen of the Lesser Spotted Dogfish (*Scyllium canicula*, Cuv.), probably at the third or fourth day of embryonic development. The embryo, which had been taken out of a living egg, was 10 mm. in length,

and in form and structure strongly resembled a young chick of the third day. The three divisions of the primitive brain were indicated : the cerebral lobes in front, the optic lobes behind forming the prominent summit of the head (slightly sunken in the specimen), and the cerebellum and medulla at the back of the head. The eye, ear, and gill-arches appeared, but the fins were not discernible. The bend of the head (cranial flexure) was distinct, and the tail had budded out. The umbilical connection of the fish with the yolk was seen; but even an expert, if shown this specimen, could scarcely have distinguished it from a young bird, so great was the resemblance. The amnion, or delicate bag enclosing the bird, was absent from the fish, and that was perhaps the main distinctive point. The specimen was thus interesting as showing how strongly the higher and lower forms resemble each other in their earliest stages of life.

Professor Thomas King showed a small collection of Flowering-plants from the Swiss Alps.

Mr. George Russell showed some plants of Mustard (*Sinapis alba*, L.) several of which had been grown from seed previously exposed to a temperature of 300 degrees below freezing-point without in any way impairing its vitality. The other plants, grown from seed not subjected to an unusual temperature, were in no way distinguishable. Similar experiments had been made with seeds of Onion and other plants, with a like result.

Mr. Richard M'Kay showed a microscopic section through a flower bud of *Lilium candidum*, Willd., illustrating the structure and arrangement of the various floral organs.

Mr. D. A. Boyd exhibited specimens of *Asteroma prunellæ*, Purt., from West Kilbride.

Mr. Boyd also read a Paper on *Helotium marchantiæ*, Berk., a Fungus new to the West of Scotland, and showed specimens found by him on the thallus of *Conocephalus conicus* (L.) near Seamill, Ayrshire.*

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## 26TH APRIL, 1892.

Mr. William Stewart, Vice-President, in the Chair.

The Secretary (Mr. D. A. Boyd) read the draft of a proposed Agreement between the Society and the Mitchell Library Committee, Glasgow, relative to the custody, binding, and maintenance of the collection of *Transactions* of other Societies and Scientific Journals received in exchange for the Society's *Proceedings and Transactions*.† On the motion of Professor Edward E. Prince, B.A., F.L.S., the proposed Agreement was unanimously approved of, and the President, a Vice-President, a Secretary, the Treasurer, and the Librarian were authorised to sign the completed deed on behalf of the Society.

* *Transactions*, vol. iii., p. 272. † See page xcii.

Professor Prince exhibited a female Haddock (*Morrhua æglefinus*) from the East Coast, measuring two feet in length, with a large melanotic tumour. The tumour, which projected from the caudal trunk about half-an-inch below the lateral line, had the form of a short stout cylinder, measuring 3 inches in height and about 7¾ inches in circumference. Much of the surface was ulcerated and presented a reddish raw appearance, and extensive black patches occurred towards the dorsal side. Around the base of the tumour the scaly integument was raised up, but the silvery appearance ceased at ½ inch to 1½ inches from the rim, and the flesh-coloured corium continued to the ulcerated surface. Examination showed that it was seated upon the surface of the caudal muscles and enveloped mainly by the corium, but did not penetrate the muscles of the interspinous bones beneath, though it lay immediately above the first anal fin, which was pushed so far from its normal place as to impart to the caudal trunk a flattened face on the side opposite the tumour. All the neighbouring tissue showed a congested appearance. To the touch the tumour was very hard, and from its position had evidently seriously impeded the movements of the tail, the lower lobe of the caudal fin being seriously abraded and partly worn away by contact with the sea-bottom.*

Mr. David Robertson, F.L.S., F.G.S., exhibited a young *Solen* with one of the valves of its shell fractured across the narrow surface from the margin to the hinge. From the dark colour of the outer edges of the fracture, the shell appeared to have been broken for a considerable time, and the asperity of the inner edges had been removed by a thick deposit of nacreous matter.

Mr. Peter Ewing exhibited a hybrid variety of *Gloxinia*, the leaves and flowers of which were fasciated in a remarkable manner.

Mr. George Russell showed a fine specimen of *Dendrobium nobile*, Lindl., var. *Cooksoni*, and stated that in this form the upper segments of the perianth are more fully developed than in the type, and bear purple markings similar to those of the lower segment or lip.

Mr. D. A. Boyd exhibited specimens of *Cæoma alliorum*, Link, a rare parasitic fungus, which has occurred, during two successive summers, on leaves of Leek (*Allium Porrum*) at Seamill, Ayrshire.

Mr. C. O. Sonntag exhibited a fine series of Marine Algæ gathered on the coast of the English Channel, with microscopic sections illustrating the characteristics of the various genera.

Professor Thomas King also showed numerous specimens of Marine Algæ mounted for microscopic examination, and described the method of cutting and preparing sections of these plants.

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* See *Tenth Annual Report of the Fishery Board for Scotland* (1892), Part III., p. 323; pl. xvii., fig. 1-3.

NATURAL HISTORY SOCIETY OF GLASGOW.

## *ABSTRACT STATEMENT OF ACCOUNTS—SESSION 1890-91.*

| | | | | | | |
|---|---|---|---|---|---|---|
| 1890.—Sept 1 | | | | | | |
| To Cash in National Security Savings Bank, | £16 | 0 | 0 | | | |
| *Less* due to Treasurer, | 9 | 1 | 9 | | | |
| | | | | £6 | 18 | 3 |
| 1891.—Aug. 31. | | | | | | |
| To 1 Life Member's Subscription, | | | | 5 | 5 | 0 |
| ,, 203 Members' Annual Subscriptions @ 7s. 6d., | | | | 76 | 2 | 6 |
| ,, 9 ,, Entry-money @ 7s. 6d., | | | | 3 | 7 | 6 |
| ,, 18 Associates' Annual Subscriptions @ 2s. 6d., | | | | 2 | 5 | 0 |
| ,, 23 Members' Arrears, | | | | 9 | 15 | 0 |
| ,, 3 Associates' ,, | | | | 0 | 7 | 6 |
| ,, *Proceedings*, etc., sold, | | | | 2 | 2 | 2½ |
| ,, Interest, | | | | 6 | 5 | 11 |
| ,, Subscriptions for Ray Society Publications (1), | | | | 24 | 16 | 6 |
| | | | | £137 | 5 | 4½ |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1891.—Aug. 31. | | | | | | |
| By Rent and Attendance, | | | | £14 | 13 | 6 |
| ,, Postage, Stationery, etc., | | | | 14 | 14 | 6½ |
| ,, Printing Circulars, | | | | 9 | 14 | 0 |
| ,, Library—Ray Society Publications (1), | | | | 38 | 4 | 0 |
| ,, ,, Other Additions, | | | | 5 | 6 | 4½ |
| ,, ,, Binding, | | | | 3 | 1 | 6 |
| ,, ,, Insurance (£300 on Books, Book-cases, etc.), | | | | 0 | 6 | 0 |
| ,, ,, Postage, Carriage, etc., | | | | 1 | 13 | 8 |
| ,, Cash on Deposit in Clydesdale Bank—Life Members' Fund (2), | | | | 15 | 10 | 0 |
| ,, Balance in National Security Savings Bank, | £38 | 0 | 0 | | | |
| *Less* due to Treasurer, | 3 | 18 | 2½ | | | |
| | | | | 34 | 1 | 9½ |
| | | | | £137 | 5 | 4½ |

Glasgow, 22*nd October*, 1891.—We have examined the Books for the year 1890-91, and have compared the Vouchers, and find them correct, the sum in the National Security Savings Bank being Thirty eight Pounds, and in the Clydesdale Bank Fifteen Pounds Ten Shillings, and the Balance due to Treasurer Three Pounds Eighteen Shillings and Twopence Halfpenny.

(Signed) THOS. G. BISHOP, D. MACKENZIE, } *Auditors.*

(1) Ray Society Publications—

| | | | |
|---|---|---|---|
| Subscriptions received last Session, | £13 | 7 | 6 |
| ,, ,, this ,, | 24 | 16 | 6 |
| | £38 | 4 | 0 |
| Cost paid this Session, | 38 | 4 | 0 |

(2) Life Members' Fund—

| | | | |
|---|---|---|---|
| Invested in 5 per cent. Debentures of The Modern Permanent Building and Investment Society, Melbourne, | £100 | 0 | 0 |
| On Deposit Receipt on Clydesdale Bank, | 15 | 10 | 0 |
| | £115 | 10 | 0 |

## MINUTE OF AGREEMENT BETWEEN THE NATURAL HISTORY SOCIETY OF GLASGOW, AND THE MITCHELL LIBRARY COMMITTEE, GLASGOW.

Minute of Agreement between the Natural History Society of Glasgow, of the first part, and Robert Graham, Wholesale Bookseller, Glasgow, Convener, and James Colquhoun, Writer, Glasgow, Sub-Convener, both of the Mitchell Library Committee, Glasgow, for and on behalf of the said Library Committee, of the second part.

The first party have agreed to hand over to the second party, and the second party have agreed to receive and keep within their library premises at number twenty-one Miller Street, Glasgow, or in such other library premises as may afterwards be occupied by them, the collection of Transactions of Societies and Scientific Journals, whether bound or unbound, obtained by the first party in exchange for their published "Proceedings and Transactions"; but subject to the whole conditions hereinafter written, viz.:

*First.*—Between the first day of September in any year, and thirty-first day of August in the year following, each member of the first party's Society, who shall have paid or compounded for his subscription to the said Society (due first September) for the year then current, shall, on production of a receipt for such subscription signed by the Treasurer of the said Society, or a certificate of Life-membership signed by one of the Secretaries and the Treasurer, and without further payment in respect of such privileges, be entitled (First) to receive from the second party's Librarian a ticket of admission to the students' reading-room within the second party's library premises, which ticket shall be used in accordance with the ordinary library regulations enacted by the second party from time to time; (Second) to consult within the said library premises any unbound part of the Transactions or Scientific Journals aftermentioned, on filling up a reader's ticket containing particulars of the publication wished to be consulted, as required by the said library regulations; and (Third) to borrow and remove from the said library premises any of the bound volumes referred to in this agreement, but subject always to the conditions hereinafter written.

*Second.*—Each borrower shall be entitled to receive two volumes at a time, and to retain them for a period of fourteen days from the date of borrowing; and the borrower shall be entitled to renew the loan for one or more similar terms, if no other application shall have been made for the volumes.

*Third.*—In the event of failure to return a book after application therefor shall have been made by the second party's Librarian, or of damage or defacement to any volume before its return to the library, the second party shall have power to replace it, charging the borrower with its cost; and until the volume shall have been returned, or the cost of its replacement recovered from him, the borrower shall not be allowed to take out any other books.

*Fourth.*—The second party shall be entitled to place within the magazine-room in their said library premises any unbound Transactions or Scientific Journals which they may desire to make more openly available for public reference.

*Fifth.*—The first and second parties' Librarians shall from time to time revise the list of Transactions and Scientific Journals received in exchange for the first party's published "Proceedings and Transactions," with the view of determining whether any such publications should be removed from the list, or others added to it.

*Sixth.*—The second party shall bind into volumes, rebind when necessary, and make available for being borrowed, the various Transactions and Scientific Journals handed over to them by the first party, and any other similar publications which may afterwards be received in exchange for the first party's "Proceedings and Transactions."

*Seventh.*—The second party shall annually reimburse the first party in (First) the cost of the copies of the first party's "Proceedings and Transactions" to be sent in exchange for such Transactions and Scientific Journals as shall be transferred by the first party to the second party in accordance with this agreement, as well as for those which may afterwards be included in the list of exchanges when revised as before mentioned, including cost of back parts sent in exchange for back numbers of Transactions and Scientific Journals when it is desired by the second party to complete imperfect sets of the latter; and the cost of all such copies shall not include any part of the expense of setting-up type or revising proofs, but shall be estimated on the basis of extra copies beyond the number required for the first party's other purposes; and (Second) the cost of transmitting by post such copies of the first party's "Proceedings and

Transactions" as may be sent in exchange as before mentioned. In witness whereof these presents, written by Daniel Alexander Boyd, residing at Seamill, West Kilbride, are subscribed in duplicate on behalf and by authority of the said Society, by Frederick Orpen Bower, Doctor of Science, Regius Professor of Botany in the University of Glasgow, the President; Robert Turner, Customs' Clerk, Glasgow, a Vice-President; James Steel, Glass-stainer, Glasgow, a Secretary; John Renwick, Produce Merchant, Glasgow, the Treasurer; and James Mitchell, Mercantile Clerk, residing at number two hundred and forty Darnley Street, Glasgow, the Librarian, all of said Society; and by the said Robert Graham and James Colquhoun for and on behalf of said Library Committee; all at Glasgow as follows: by the said Frederick Orpen Bower, on the tenth day of May in the year Eighteen hundred and ninety-two, before these witnesses, Benjamin George Cormack, Professor's Assistant, Glasgow University, and William Kilpatrick Hutton, Student, residing at Mansfield, Lenzie; by the said Robert Turner and John Renwick, both on the eleventh day of said month of May, before these witnesses, John Joseph O'Halloran and Henry O'Halloran, both Customs' Clerks, Glasgow; by the said James Steel and James Mitchell, both on the eleventh day of said month of May, before these witnesses, John Paton Clingan, Packing-box Maker, residing at number thirty-one Taylor Street, Glasgow, and Thomas Mitchell, Mercantile Clerk, residing at number two hundred and forty Darnley Street, Glasgow; by the said Robert Graham, on the sixteenth day of said month of May, before these witnesses, Franklin Trengrouse Barrett and Henry Young Simpson, both Assistant Librarians in the Mitchell Library, Glasgow; and by the said James Colquhoun, on the twenty-first day of said month of May, before these witnesses, Robert Adams and James Cameron Ewing, both Assistant Librarians in said Library.

| | |
|---|---|
| (Signed) | (Signed) |
| B. G. Cormack, Witness.<br>W. H. Hutton, Witness. | Frederick Orpen Bower. |
| J. J. O'Halloran, Witness.<br>H. O'Halloran, Witness. | R. Turner. |
| John P. Clingan, Witness. | John Renwick. |
| Thomas Mitchell, Witness. | James Steel. |
| Franklin T. Barrett, Witness. | James Mitchell. |
| Henry Y. Simpson, Witness. | Robert Graham. |
| Robert Adams, Witness.<br>James C. Ewing, Witness. | Jas. Colquhoun. |

# *LIST OF SOCIETIES, ETC., WITH WHICH PUBLICATIONS ARE EXCHANGED.*

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Alberta, Macleod, N.W.T.—Macleod Historical Society.
Alnwick.—Berwickshire Naturalists' Field Club.
Amsterdam.—Koninklijke Akadamie van Wettenschappen.
Barrow.—Naturalists' Field Club.
Basel.—Naturforschende Gesellschaft.
Bath.—Natural History and Antiquarian Field Club.
Belfast.—Naturalists' Field Club.
Natural History and Philosophic Society.
Bergen.—Museum.
Birmingham.—Philosophical Society.
Bonn.—Naturhistorischer Verein der Preussischen Rheinlande und Westfalens.
Bordeaux.—Société Linnéenne.
Boston.—Society of Natural History.
Braunsweig.—Verein für Naturwissenschaft.
Bremen.—Naturwissenschaftlicher Verein.
Bridgeport, Conn.—Scientific Society.
Brighton.—Brighton and Sussex Natural History Society.
Brisbane.—Queensland Branch of Royal Geographical Society of Australasia.
Bristol.—Naturalists' Society.
Brünn.—Naturforschender Verein.
Brussels.—Société Entomologique de Belgique.
Société Malacologique de Belgique.
Société Royale de Botanique de Belgique.
Budapest.—Királyi Magyar Természettudományi Társulat.
Buenos Ayres.—Musée de La Plata.
Cambridge, Mass.—Entomological Club.
Museum of Comparative Zoology of Harvard College.
Nuttal Ornithological Club.
Cardiff.—Naturalists' Society.
Cassel.—Verein für Naturkunde.
Chapel-Hill, N.C.—Elisha Mitchell Scientific Society.
Cherbourg.—Société Nationale de Sciences Naturelles et Mathématiques.
Chester.—Society of Natural Science.
Christiania.—Royal University of Norway.

Cincinnati.—Society of Natural History.
Cordoba.—Academia Nacionale de Ciencias.
Danzig.—Naturforschende Gesellschaft.
Davenport.—Academy of Natural Sciences.
Dresden.—Naturwissenschaftliche Gesellschaft "Isis."
Dublin.—Royal Dublin Society.
Dumfries.—Dumfriesshire and Galloway Natural History and Antiquarian Society.
Dundee.—East of Scotland Union of Naturalists' Societies.
Eastbourne.—Naturalists' History Society.
Edinburgh.—Botanical Society.
Field Naturalists' and Microscopical Society.
Geological Society.
Royal Physical Society.
Scottish Geographical Society.
Elberfeld.—Naturwissenschaftlicher Verein.
Essex.—Epping Forest and Essex Naturalists' Field Club.
Florence.—Società Entomologica Italiana.
Frankfurt.—Senckenbergische Naturforschende Gesellschaft.
Gent.—Natuurwettenschappen.
Glasgow.—Archæological Society.
Baillie's Institution Free Library.
Faculty of Physicians and Surgeons.
Geological Society.
Industrial Museum.
Mitchell Library.
Philosophical Society.
Stirling's Library.
University Library.
Giessen.—Oberhessische Gesellschaft für Natur und Heilkunde.
Gorlitz.—Naturforschenden Gesellschaft.
Granville, Ohio.—Denison University.
Graz.—Naturwissenschaftlicher Verein für Steiermark.
Griefswald.—Naturwissenschaftliche Vereine von Neu-Vorpommern und Rügen.
Halifax.—Nova Scotian Institute of Natural Science.
Halle.—Naturforschende Gesellschaft.
Leopoldina.
Hamburg.—Naturwissenschaftlicher Verein für Hamburg-Altona.
Heidelberg.—Naturhistorisch-medicinisher Verein.
Helsingfors.—Societas pro Fauna et Flora Fennica.
Kiel.—Naturwissenschaftlicher Verein für Schleswig-Holstein.
Kiew.—Société des Naturalistes à l'Université Impériale de St. Wladimie.
Koenigsberg.—Physikalisch-ökonomische Gesellschaft.
Landshut.—Bavarian Botanical Society.
Lawrence.—University of Kansas.

Leeds.—Naturalists' Club and Scientific Association.
Yorkshire Naturalists' Union.
Leicester.—Literary and Philosophical Society.
Leipzig.—Insekten-Börse.
Liége.—Société Royale des Sciences.
Liverpool.—Naturalists' Field Club.
Biological Society.
London.—British Museum Library.
British Museum (Natural History Department).
British Association.
Entomological Society.
Geologists' Association.
Hampstead Naturalists' Club.
Linnean Society.
Quekett Microscopical Club.
Royal Geographical Society.
Royal Microscopical Society.
London, Ontario.—Entomological Society of Ontario.
Luxemburg.—Fauna.
Lyons.—Société Linnéenne.
Madrid.—Sociedad Española de Historia Natural.
Manchester.—Field Naturalists' and Archæologists' Society.
Geological Society.
Literary and Philosophical Society.
Microscopical Society.
Marlborough.—The College Natural History Society.
Melbourne.—Library and Museum of Victoria.
Meriden, Conn.—Scientific Association.
Metz.—Société d'Histoire Naturelle.
Mexico.—Sociedad Cientifica "Antonio Alzate."
Minneapolis.—Minnesota Academy of Natural Sciences.
Moscow.—Société Impériale des Naturalistes.
Münster.—Westfälischer Provinzial-Verein für Wissenschaft und Kunst.
Neuchâtel.—Société des Sciences Naturelles.
New Brighton.—Natural Science Association of Staten Island.
New Brunswick.—Natural History Society.
Newcastle-on-Tyne.—Tyneside Naturalists' Field Club.
Newhaven, Conn.—Academy of Arts and Sciences.
New York.—Academy of Sciences.
Linnæan Society.
Microscopical Society.
Journal of Comparative Medicine and Surgery.
Scientific Alliance of New York.
The Auk.
Northampton.—Natural History Society.
Norwich.—Norfolk and Norwich Naturalists' Society.

Nürnberg.—Naturhistorische Gesellschaft.
Odessa.—Society of Naturalists of New Russia.
Osnabrück.—Naturwissenschaftlicher Verein.
Ottawa.—Geological and Natural History Survey.

Padua.—La Nuova Notarisia.
Società Veneto-Trentina di Scienze Naturali.

Paisley.—Free Library.
Paris.—Société Entomologique de France.
Société Zoologique de France.
Passau.—Naturhistorischer Verein.
Penzance.—Natural History and Antiquarian Society.
Perth.—Perthshire Society of Natural Science.
Philadelphia.—Academy of Natural Sciences.
Wagner Free Institute of Science.
Plymouth.—Plymouth Institution, and Devon and Cornwall Natural History Society.
Poughkeepsie.—Vassar Brothers Institute.
Prague.—Königl. Böhm. Gesellschaft der Wissenschaften.

Rio de Janeiro.—Museum Nacional.
Rochester, N.Y.—Academy of Science.
Rome.—Scienze Geologiche Roma.
Societa Romana per gli Studi Zoologici.

San Francisco.—California Academy of Sciences.
St. Louis, Mass.—Academy of Science.
Missouri Botanical Garden.
St. Petersburg.—Comité Géologique.
Entomological Society of St. Petersburg.
Salem, Mass.—Essex Institute.
Santiago.—Deutschen Wissenschaftlicher Verein zu Santiago.
Schaffhausen.—Société Entomologique Suisse.
Sgravenhage.—Nederlandsche Entomologische Vereeniging.
Staffordshire.—North Staffordshire Naturalists' Field Club.
Stettin.—Entomologische Zeitung.
Stuttgart.—Verein für Vaterländische Naturkunde in Würtemberg.
Sydney.—Australian Museum.

Tokio.—Japanese University.
Toronto.—Canadian Institute.
University of Toronto.
Trencsén.—Természettudományi Egylet.
Trenton, N.J.—Natural History Society.
Trieste.—Società Adriatica di Scienze Naturali.
Truro.—Royal Institution of Cornwall.

Venice.—Notarisia.
Vienna.—Kaiserlich-Königliche Zoologisch-botanische Gesellschaft.

Vienna.—Ornithologischer Verein.
Naturhistorische Hofmuseums.
Warwick.—Naturalists' and Archæologists' Field Club.
Washington.—Smithsonian Institution.
United States Department of Agriculture.
United States Geological and Geographical Survey.
United States National Museum.
Watford.—Hertfordshire Natural History Society and Field Club.
Wellington, N.Z.—New Zealand Institute.
Winnipeg.—Historical and Scientific Society.
Wisconsin.—Natural History Society.

*October, 1892.*

# Natural History Society of Glasgow.

SESSION XLII.—1892-93.

## LIST OF OFFICE-BEARERS.

*President.*

Professor F. O. BOWER, D.Sc., F.R.S., F.R.S.E., F.L.S.
Glasgow University.

*Vice-Presidents.*

WILLIAM STEWART, Violetgrove House, St. George's Road.
R. S. WISHART, M.A., Salisbury Cottage, Chryston.
Professor EDWARD E. PRINCE, B.A., F.L.S., St. Mungo's College,

*Hon. Secretaries.*

D. A. BOYD, Seamill, West Kilbride, Ayrshire.
JOHN CAIRNS, Jun., 151 Renfrew Street.

*Hon. Treasurer.*

JOHN RENWICK, 49 Jamaica Street.

*Hon. Librarian.*

JAMES MITCHELL, 240 Darnley Street, Pollokshields.

*Members of Council.*

PETER EWING.
JOHNSTON SHEARER.
CHRISTOPHER SHERRY.
JOSEPH SOMMERVILLE.
ROBERT EDGAR, M.A.
ROBERT GRIERSON.
DUNCAN M'LAREN.
D. CORSE GLEN, C.E., F.G.S.
ALEXANDER HILL.
DUNCAN MACKENZIE.
JAMES STEEL.
(One vacancy).

# LIST OF MEMBERS.

* *Life Members.*

## *HONORARY.*

1851. William Ferguson of Kinmundy, F.R.S.E., F.L.S., F.G.S., etc., 21 Manor Place, Edinburgh, and Kinmundy, near Mintlaw, Aberdeenshire.

1880. John Obadiah Westwood, M.A., F.L.S., F.E.S., Professor of Zoology, Oxford.

1880. Professor Gustav Mayr, 75 Haupt Strasse, Vienna.

1880. Rev. John Stevenson, LL.D., F.R.S.E., The Manse, Glamis, Forfarshire.

1881. James Murie, M.D., LL.D., F.L.S., F.G.S., F.Z.S., Canvey Cottage, Leigh, Essex.

1881. Osbert Salvin, M.A., F.R.S., F.L.S., F.Z.S., F.R.H.S., Hawksfold, Fernhurst, Haslemere, Surrey.

1884. David Sharp, M.B., C.M., F.L.S., F.Z.S., F.E.S., Hawthorndene, Hills Road, Cambridge.

1884. Robert M'Lachlan, F.R.S., F.L.S., F.Z.S., F.E.S., West View, Clarendon Road, Lewisham, London, S.E.

1885. John Murray, LL.D., Ph.D., F.R.S.E., F.L.S., F.S.A.Scot., Director of the *Challenger* Expedition Commission, 32 Queen Street, Edinburgh.

1887. William Carruthers, F.R.S., F.L.S., F.G.S., Keeper of the Botanical Collection, British Museum (Natural History), Cromwell Road, London, S.W.

1887. Sir Joseph Dalton Hooker, M.D., R.N., K.C.S.I., C.B., D.C.L., LL.D., F.R.S., F.L.S., F.G.S., etc., The Camp, Sunningdale, Berks.

1887. Sir Richard Owen, K.C.B., D.C.L., LL.D., F.R.C.S., F.R.S., F.L.S., F.G.S., etc., Sheen Lodge, Richmond Park, East Sheen.

1888. Rev. Canon Alfred Merle Norman, M.A., D.C.L., F.L.S., Burnmoor Rectory, Fence Houses, Co. Durham.

1888. Charles Cardale Babington, M.A., F.R.S., F.L.S., F.G.S., Professor of Botany in the University of Cambridge, 5 Brookside, Cambridge.

1889. The Duke of Argyll, K.G., K.T., D.C.L., LL.D., F.R.S., Inveraray Castle, Argyllshire.

1890. M. C. Cooke, M.A., LL.D., A.L.S., 146 Junction Road, Upper Holloway, London, N.

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The reference to the pages of the *Transactions* are indicated by figures, and to those of the *Proceedings* by Roman numerals.

Species, etc., described in the *Transactions* are denoted by an asterisk.

## VERTEBRATES.

## ZOOLOGY.

† As the Abstract appended to p. 158 of the *Transactions* contains a reference to all the species and varieties of English Upper Silurian Ostracoda mentioned on pp. 140-155, it is not included in this Index, except in reference to a few Ostracoda (denoted by "158a") which are not mentioned elsewhere in the *Transactions*.

## BOTANY.

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